



Analysis of Carbon Disclosure Data for U.S. Equities Within the Electricity Generation Sector

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Analysis of Carbon Disclosure Data for U.S. Equities
Within the Electricity Generation Sector

Lynne Sweet McIntosh

A Thesis in the Field of Sustainability and Environmental Management
for the Degree of Master of Liberal Arts in Extension Studies

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Abstract

With the historic international climate agreement made in Paris still fresh in their minds, investors are looking at Environmental, Social and Governance (ESG) data to increase alpha in the upcoming low carbon economy. By identifying the non-financial data that is material to a particular company and/or its sector, investors hope to gain insight into the company's performance. In the electric generating sector, the company's "impact on the environment" has been identified as one of the material ESG factors. Included in this impact are the company's greenhouse gas (GHG) emissions as seen in their carbon footprint. This footprint is a measure of the company's "climate-friendliness" or contribution to climate change (Raynaud, 2015). Analyzing a company's carbon footprint is an integral part of the risk assessment of the entity. Consistency of carbon data, critical to the risk assessment, has been a concern. Both investors and asset managers are interested in climate change risks and how these will affect their investment and portfolios.

The 2013 GHG emissions data disclosed by the electric generation sector, one of the most carbon intensive sectors, was analyzed using regulatory and voluntary data disclosures. This data was collected for 29 large and mid-size electric utilities which are U.S. parent companies publicly traded on the New York Stock Exchange (NYSE). Research was done to determine if the emissions that these companies are voluntarily disclosing within their annual 10-K report, sustainability/corporate social responsibility (CSR) reports and to the Carbon Disclosure Project (CDP) are consistent and

“reasonable”. This research evaluated whether GHG emissions being reported by the companies are a true measure of the company’s “climate friendliness”.

In 2013, 11 out of 29 companies (38%) made no mention of their GHG emissions in the annual 10-K reports filed with the SEC. The emissions disclosed in the various sources indicated that most electric utilities were disclosing the minimum level of scope 1 stationary combustion emissions. Scope 2 emissions from Transmission & Distribution (T&D) losses were not openly disclosed by 22 out 29 companies (76%). Scope 3 emissions from purchased electricity also were not disclosed for the majority (76%) of electric utilities. Of the scope 2 and 3 emissions that were disclosed, more than half of them did not pass the “reasonable” test. It appears that some electric generation utilities are not properly reporting the emissions associated with business activities, their true “climate friendliness”. It is also difficult to compare the GHG emissions across companies within the electric generation sector, due to the inconsistencies in the emissions calculations.

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Definition of Terms

Many of the terms in this document were obtained from the GHG Protocol and the Climate Registry General Reporting Protocol.

Alpha – The excess return on an investment's suitable index or peer group (i.e. ABC Index and XYZ fund had IRRs of 10% and 11% respectively, XYZ has an alpha of 1%) (Investopedia, 2016).

Carbon accounting - The foundation of carbon accounting is the calculation of an organization's greenhouse gas emissions and the analysis of the risk that climate change may have on their business. This includes measuring, monitoring and reporting greenhouse gas emissions as carbon dioxide equivalents for processes that the entity has direct and/or indirect control over.

Carbon dioxide (CO₂) equivalent – The universal unit of measurement to indicate the global warming potential of each of the six (plus NF₃) GHGs regulated by the Kyoto Protocol, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoid releasing) different GHG emissions against a common basis (WRI & WBCSD, 2000).

Carbon footprint – Defined by the Environmental Protection Agency (EPA) as the total amount of greenhouse gases that are emitted into the atmosphere each year by an entity such as a person, household, building, organization or company. Also called GHG footprint (EPA, 2016d).

Control Approach – An emissions accounting approach for defining organizational boundaries in which an entity reports 100 percent of the GHG emissions from operations under its financial or operational control (TCR, 2013).

Direct emissions – Emissions from sources within the reporting entity's organizational boundaries that are owned or controlled by the reporting entity, including stationary combustion emissions, mobile combustion emissions, process emissions, and fugitive emissions (TCR, 2013).

Emission factor - GHG emissions expressed on a per unit activity basis (for example, metric tonnes of CO₂ emitted per million BTUs of coal combusted, or metric tonnes of CO₂ emitted per kWh of electricity consumed) (TCR, 2013).

Emissions – The release of GHGs into the atmosphere (WRI & WBCSD, 2000).

Equity share approach – An emissions accounting approach for defining organizational boundaries in which an entity accounts for GHG emissions from each operation according to its share of economic interest in the operation, which is the extent of rights an entity has to the risks and rewards flowing from an operation (TCR, 2013).

Financial Control – The ability to direct the financial and operating policies of an operation with an interest in gaining economic benefits from its activities. Financial control is one of ways to define the control approach (TCR, 2013).

Fugitive emissions – Intentional or unintentional releases from the production, processing, transmission, storage, and use of fuels and other substances, that do not pass through a stack, chimney, vent, exhaust pipe or other functionally equivalent opening. Examples include releases of sulfur hexafluoride (SF₆) from electrical equipment; hydrofluorocarbons (HFC) releases during the use of refrigeration and air conditioning

equipment; landfill gas emissions; and methane leakage from natural gas transport (TCR, 2013).

Global Warming Potential (GWP) – The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one unit of a given GHG compared to one unit of carbon dioxide (CO₂) (TCR, 2013).

Greenhouse gases (GHGs) – Gases that contribute to the greenhouse effect, trapping heat in the atmosphere. These gases are the six gases listed in the Kyoto Protocol: CO₂, CH₄, N₂O, HFCs, PFCs and SF₆. NF₃ was recently added to the list (WRI & WBCSD, 2000).

Greenhouse gas registry – A database for collecting, verifying, and tracking emissions data from emitters, such as facilities or companies (WRI & WBCSD, 2000).

Hydrofluorocarbons (HFCs) - A group of manmade organic compounds with various commercial uses (e.g., refrigerants) composed of one or two carbon atoms and varying numbers of hydrogen and fluorine atoms. Most HFCs are highly potent GHGs with 100-year GWPs in the thousands (TCR, 2013).

Indirect emissions – Emissions that are a consequence of activities that take place within the organizational boundaries of the entity, but that occur at sources owned or controlled by another entity. For example, emissions of electricity used by manufacturing entity that occur at a power plant represent the manufacturer's indirect emissions (Scope 2 and 3) (TCR, 2013).

Intergovernmental Panel on Climate Change - (IPCC) International body of climate change scientists. The role of the IPCC is to assess the scientific, technical and socio-economic information relevant to the understanding of the risk of human-induced climate change (WRI & WBCSD, 2000).

Inventory – A quantified compilation of an organization’s GHG emissions and sources (WRI & WBCSD, 2000).

Kyoto Protocol – A protocol to the UNFCCC. It requires countries listed in its Annex B (developed nations) to meet reduction targets of GHG emissions relative to their 1990 levels averaged over the period 2008-2012 (WRI & WBCSD, 2000).

Mobile Combustion Emissions - Emissions from the combustion of fuels and refrigerant leaks in transportation sources (e.g. cars, trucks, buses, trains, airplanes, and marine vessels) and emissions from non-road equipment such as equipment used in construction, agriculture, and forestry. A piece of equipment that cannot move under its own power but that is transported from site to site (e.g., an emergency generator) is a stationary, not a mobile, combustion source (Scope 1) (TCR, 2013).

Operational Boundaries – The boundaries that determine the direct and indirect emissions associated with operations within the Member’s organizational boundaries (TCR, 2013).

Operational Control – Full authority to introduce and implement operating policies at an operation. Operational control is one of two ways to define the control approach (TCR, 2013).

Organizational Boundaries – The boundaries that determine the operations owned or controlled by the reporting entity, depending on the consolidation approach taken (either the equity share or control approach) (TCR, 2013).

Perfluorocarbons (PFC) - A group of man-made chemicals composed of one or two carbon atoms and four to six fluorine atoms, containing no chlorine. PFCs have no commercial uses and are emitted as a byproduct of aluminum smelting and

semiconductor manufacturing. PFCs have very high GWPs and are very long-lived in the atmosphere (TCR, 2013).

Process Emissions - Emissions resulting from physical or chemical processes other than from fuel combustion. Examples include emissions from manufacturing cement, aluminum, adipic acid, ammonia, etc. (TCR, 2013).

Scope 1 Emissions - All direct GHG emissions, with the exception of direct CO₂ emissions from biogenic sources (TCR, 2013).

Scope 2 Emissions - Indirect GHG emissions associated with the consumption of purchased or acquired electricity, heating, cooling, or steam (TCR, 2013).

Scope 3 Emissions - All indirect emissions not covered in Scope 2. Examples include upstream and downstream emissions, emissions resulting from the extraction and production of purchased materials and fuels, transport related activities in vehicles not owned or controlled by the reporting entity, use of sold products and services, outsourced activities, recycling of used products, waste disposal, etc. (TCR, 2013).

Social Responsible Investing - There is no single term to describe SRI. Depending on their emphasis, investors use such labels as: “community investing,” “ethical investing,” “green investing,” “impact investing,” “mission-related investing,” “responsible investing,” “socially responsible investing,” “sustainable investing” and “values-based investing,” among others. For example, sustainable, responsible and impact investing (SRI) is an investment discipline that considers environmental, social and corporate governance (ESG) criteria to generate long-term competitive financial returns and positive societal impact (US SIF, 2016).

Stationary Combustion Emissions - Emissions from the combustion of fuels in any stationary equipment including boilers, furnaces, burners, turbines, heaters, incinerators, engines, flares, etc. (TCR, 2013).

Sustainability - The AICPA defines sustainability as the triple bottom-line consideration of: economic viability, social responsibility and environmental responsibility (AICPA, 2012).

Tonne – One metric ton, with a mass equal to 1,000 kilograms, or 2,205 pounds (abbreviated as t) (WRI & WBCSD, 2000).

Transparency - Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used (WRI & WBCSD, 2000).

Verification - It is the process used to ensure that a reported greenhouse gas emissions inventory has met a minimum quality standard and has complied with the appropriate procedures and protocols for calculating and reporting greenhouse gas emissions (Adapted from TCR definition, 2013).

Acronyms

ACWI	All Country World Index
AMP	Air Markets Program
AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CEMS	Continuous Emission Monitoring System
CFR	Code of Federal Regulations
CH ₄	Methane
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide equivalents
COP	Conference of the Parties
CR	Corporate Responsibility
CSR	Corporate Social Responsibility
EDF	Environmental Defense Fund
eGRID	Emissions & Generation Resource Integrated Database
EIA	Energy Information Administration (U.S.)
EPA	Environmental Protection Agency (U.S.)
ESG	Environmental, Social and Governance

ETS	Emissions Trading Scheme
FERC	Federal Energy Regulatory Commission
FLIGHT	Facility Level Information on GreenHouse gases Tool
FTE	Full Time Employee
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
ISO	Individual System Operator
ISO	International Organization for Standardization
lbs	Pounds
MJB	M. J. Bradley & Associates
MT	Metric Tonne (1000 kg or 2205 lbs)
MWh	Megawatt hour
N ₂ O	Nitrous Oxide
NAICS	North American Industry Classification System
NF ₃	Nitrogen trifluoride
NYSE	New York Stock Exchange
OECD	Organization for Economic Co-operation and Development
ORIS	Office of Regulatory Information Systems (plant code)
PFCs	Perfluorocarbons
PwC	PricewaterhouseCoopers

SAR	Second Assessment Report of the Intergovernmental Panel on Climate Change
SASB	Sustainability Accounting Standards Board
SEC	Securities and Exchange Commission
SF ₆	Sulfur hexafluoride
SRI	Social Responsible Investing
ST	Short Ton (2000 lbs.)
t	Metric Tonne (1000 kg or 2205 lbs)
T&D	Transmission and Distribution (electrical)
TAR	Third Assessment Report of the Intergovernmental Panel on Climate Change
TCR	The Climate Registry
TRI	Toxic Release Inventory Program
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Chapter I

Introduction

In 2014, more than \$6.5 trillion of total assets under management in the United States were involved in Social Responsible Investing (SRI) (US SIF, 2016). Examples of SRI investors can be found throughout the United States including individuals, credit unions and community development banks, hospitals and medical schools, foundations, religious institutions, venture capitalists, responsible property funds and public pension plan (US SIF, 2016). The results of this research study are geared for the average SRI investor, not for a sustainability professional or professional asset manager that may have access to extensive third party information to help make decisions.

These average investors are searching for company ESG information via their annual reports, 10-K reports, the Carbon Disclosure Project (CDP) and sustainability/CSR reports to see what ESG issues the companies are disclosing. Investors are interested in finding out what type of climate risks the companies face in the low carbon future and how transparent the companies are disclosing the “climate friendliness” of their company.

Research Significance and Objectives

Climate-conscious investing is now taking place on Wall Street (CDP, 2015). Just as there is no single financial metric that is used to assess financial risk and performance, there is no single carbon metric that captures all the company’s climate risks and performance. Climate change risks depend on many different issues including

the physical location of the enterprise, the company's suppliers, climate legislation in place, and the carbon intensity of the business. A company's carbon footprint is a static measure of their GHG emissions, but it can be used to capture information about the carbon intensity of the company. Investors are concerned about the carbon exposure of companies within their investment portfolios and are now analyzing company carbon footprints.

The research performed in this study evaluated the "reasonableness" and consistency of the carbon emissions disclosed by some of the U.S. medium and large cap electric utilities. Of particular importance are their scope 1 and 2 emissions, as these are the emissions used in calculating the carbon intensity of the company, one of the metrics used in comparing companies. Scope 1 and 2 emissions are also used in calculating the investment portfolio's carbon footprint. Essentially the portfolio carbon footprint measures "the carbon emissions and intensity associated with operations of all the companies in a portfolio relative to a given benchmark (Apfel, W. A. and Zuilkowski, 2016). MCSI calculated the carbon emissions for their All Country World Index (ACWI) and found that on September 21, 2015 the Utilities, Material and Energy sectors comprised 80% of the total ACWI carbon emissions for the index, but they only represented 15% of the portfolio weight (MSCI, 2015).

Third party carbon data providers will compile carbon emissions data from various sources in which the companies have disclosed their emissions. Often they just report the emissions that the companies have disclosed and do not do any "reasonable" test on the data. Some of the carbon data providers will also estimate or model the emissions for the companies that haven't disclosed their emissions so that investors can calculate their portfolio carbon footprints. Data quality is a key issue in these analyses

and incomplete or inaccurate emissions data will affect the decisions being made by everyone involved. Inconsistencies in the calculation of the emissions are also a problem due to various standards and protocols being used, as well as different emission factors and GWPs being utilized. These inconsistent emissions calculations make it difficult to compare emissions within the electric generation utilities.

Background

The Earth's climate depends on certain gases in the atmosphere to keep it warm through a process called the greenhouse effect. These "greenhouse" gases (GHG) trap the heat to keep the planet warm. Human activities, such as burning fossil fuels, are increasing the concentration of these gases in the atmosphere and oceans causing the Earth to get warmer. From Figure 1, it can be seen that in 2013 carbon dioxide (82%) was the most prevalent GHG in the United States (EPA, 2016e).

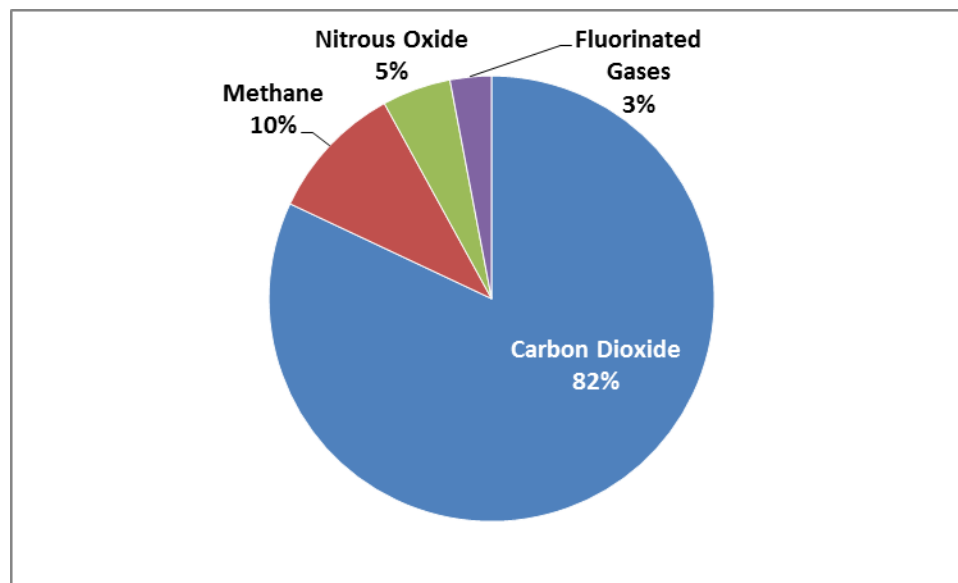


Figure 1. U.S. greenhouse gas emissions in 2013.

Figure 2 shows that 31% of the GHG produced in 2013 came from the electric generation sector, making this sector of the economy the most carbon intensive due to the large quantities of fossil fuels burned in the generation of electricity (EPA, 2016e).

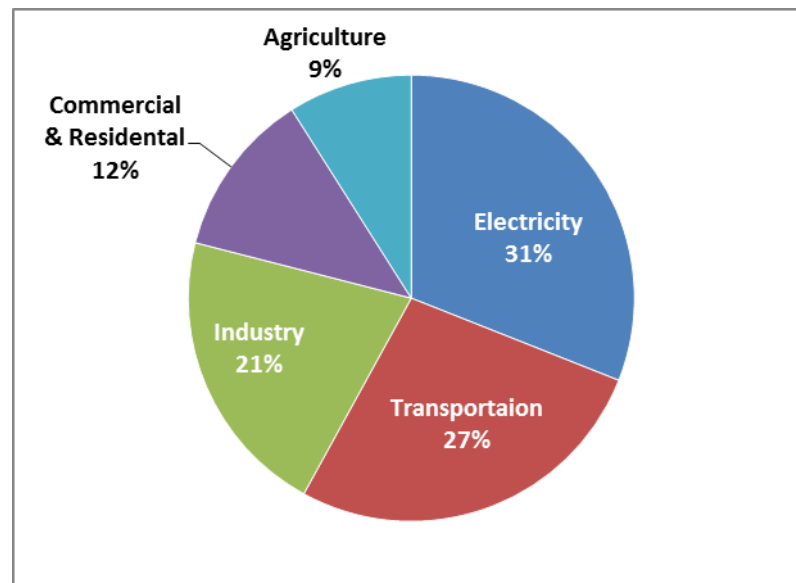


Figure 2. Total U.S. greenhouse gas emissions by economic sector in 2013.

The potential impacts of greenhouse gas emissions have been a concern since the 1960s when scientists around the world began to investigate greenhouse gas emissions and the human-caused global warming. Governments decided in the mid-80s that an independent impartial body was needed to study this complex issue. In 1988, the United Nations Intergovernmental Panel on Climate Change (IPCC) was established to assess the scientific, technical and socio-economic information relevant to the understanding of the risk of human-induced climate change (IPCC, 2013). In 1992 at the Rio Earth Summit, the United Nations Framework Convention on Climate Change (UNFCCC) was signed and provides the overall framework for international efforts to mitigate climate change (United Nations, 1997). Meetings or Conferences of the Parties (COP) have been

held annually since 1995 in different locations around the world. More than 180 nations comprise COP (EPA, 2016d).

Kyoto, Japan was the location chosen for the third meeting (UNFCCC, 1997). The resulting agreement, the Kyoto Protocol, was proposed in December of 1997 (UNFCCC, 1997). The countries that ratified the protocol committed to reduce their greenhouse gas emissions (meaning naturally occurring carbon dioxide, methane, nitrous oxide, man-made sulfur hexafluoride, hydrofluorocarbons and perfluorocarbons) by 5.2 percent from their 1990 levels during the time frame of 2008 – 2012 (UNFCCC, 1997).

According to the Environmental Protection Agency (EPA), the term carbon footprint describes “the total amount of greenhouse gases that are emitted into the atmosphere each year by an entity such as a person, household, building, organization or company” (EPA, 2016d). A company’s carbon footprint is a measure of its “climate-friendliness” or contribution to climate change (Raynaud, 2015). For example, when an electric generation company calculates its greenhouse gas or carbon footprint (the terms “carbon”, “greenhouse gases” and “GHG” are used interchangeably within this paper), it is an estimation of the gases that were released into the atmosphere as a result of burning fossil fuels in the boilers to heat water into steam, used in the generation of electricity (stationary combustion). The amount of fuel used for a year is measured and recorded, as well as the amount of GHG produced in the process using continuous emission monitoring systems (CEMS).

Emissions from the stationary combustion of the fossil fuels during electricity generation will be used to calculate this portion of the company’s direct or scope 1 emissions. Many different variables go into determining the magnitude of the footprint, including the amount of electricity produced using the fossil fuels, the fossil fuel mix

burned (coal, natural gas or oil), the efficiency of the equipment and the calculations that were performed to arrive at the final GHG emissions footprint. There are numerous GHG guides or protocols available that help with the calculation of the GHG inventory, but there is no regulated standard. This lack of a standard results in inconsistent calculations of the emissions which does pose problems for comparability of the end product. Organizations are encouraged to use the GHG Protocol Corporate Accounting and Reporting Standard Revised Edition (GHG Protocol) written by the World Business Council for Sustainable Development (WBCSD) and the World Resource Institute (WRI) to calculate their emissions (WRI & WBCSD, 2000). The GHG Protocol is based on the GHG accounting and reporting principles seen below in Table 1 (WRI & WBCSD, 2000):

Table 1. GHG accounting and reporting principles from the GHG protocol.

Relevance	Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.
Completeness	Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.
Consistency	Use consistent methodologies to allow for meaningful comparisons of emission over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
Transparency	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
Accuracy	Ensure that the quantification of GHG emission is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

There is business value for any company to calculate its carbon footprint or GHG inventory (WRI & WBCSD, 2000). To begin with, a company can't manage what it doesn't measure. If a company doesn't measure the energy used in a process, then it is hard to undertake programs that involve reducing energy consumption. Developing a company's GHG inventory is a multi-step process that takes careful attention to quality control issues of the process involved. Reliable activity data is necessary to estimate the GHG emissions. The GHG Protocol and The Climate Registry (TCR) both have guidance and tools on how to develop a GHG inventory ((TCR, 2013).

Once the company has a GHG inventory plan that is both well designed and maintained, it can help with managing its GHG risks and opportunities. Businesses need to understand and manage their GHG risks to enable their company to succeed in the low carbon future. Once this inventory plan has been developed and maintained, a company can consider disclosing its emissions in its annual reports or to voluntary reporting programs such as the CDP. If companies are carbon intensive, they will also need to collect information for regulatory GHG reporting programs.

GHG emissions are the center of the climate change debate. They will need to be reduced if there is hope of keeping the global temperature rise below 2° C. In a recent study released by Greenbiz and Ingersoll Rand titled *Accountability for Climate Action*, their findings showed that businesses are working hard to reduce their impacts (Greenbiz, 2016). They found that a large number of the businesses have pledged to at least one of the following commitments: (1) reduce carbon dioxide (CO₂) and greenhouse gas (GHG) emissions, (2) install or purchase renewable energy, or (3) increase energy efficiency (Greenbiz, 2016). Their research showed that there was a greater emphasis on

commitments that reduced GHG emissions and that the biggest businesses had made the biggest commitments (Greenbiz, 2016).

In order to increase alpha, investors are looking at ESG data, such as a company's commitment to reduce their carbon footprints. They are using the company's self-assessed non-financial material data to gain insight into the company's performance. Investors and asset managers are also using the carbon footprints of their investments to calculate the carbon footprint of their portfolios. They are using the portfolio's footprint to determine its exposure to climate risk and to establish a baseline, much like what individual companies undertake.

Investors have also become interested in carbon footprints through a number of investor initiatives. One such initiative is the Global Investor Statement on Climate Change which calls for governments to "provide stable, reliable and economically meaningful carbon pricing that helps redirect investment commensurate with the scale of the climate change challenge" (Global Investor Statement, 2014). The Montreal Carbon Pledge (PRI, 2016) advocates that investors need to measure and disclose the carbon footprint of their portfolios, while the multi-stakeholder initiative Portfolio Decarbonization Coalition (PDC) has been mobilizing the financial markets to decarbonize their portfolios (CDP and UNEP, 2016). Governments are even getting involved. France passed legislation in May 2015 requiring institutional investors to disclose carbon exposure (Repetto, 2016).

There has also been a push by the investor community to get large companies around the world to publish sustainability reports and disclose their carbon emissions. If the companies resist, then Shareholder Resolutions are initiated by the investors. One such shareholders' request was recently filed for OGE Energy Corp to issue a

sustainability report detailing the company's present policies in key ESG targets (Ceres, 2016a). CDP has also made an effort to get companies to disclose their GHG emissions. Their website says that 5,500 companies have responded to their 2015 annual climate change questionnaire and one quarter of the world's carbon emissions are managed through CDP (CDP, 2016).

With all this focus on GHG emissions, what do the numbers look like? Most of the emissions are self-assessed reported amounts. These nonfinancial numbers are being used in a financial nature, but most of them have not gone through the rigorous audit process that financial statement numbers are required to undergo. I analyzed the "reasonableness" of the GHG emissions data disclosed by the electric generation sector, one of the most carbon intensive sectors, using regulatory and voluntary data disclosures. This data was collected for 29 large and mid-size electric generation utilities which are publicly traded U.S. parent companies. Testing was done to determine if the emissions that these companies are voluntarily disclosing within their annual 10-K statements, sustainability/CSR reports and to CDP were consistent and "reasonable".

Boundaries

Before an organization can calculate its carbon footprint, it needs to make several decisions about what types of boundaries it's going to use and what type of consolidation approach it's going to take. These are similar decisions that need to be made when a company puts together their financial statements. Ideally the GHG inventory will have the same boundaries and consolidation approach as the financial statements, so if a price of carbon is used by the company in its planning, the price can be included in the financial projections without having to make adjustments for the boundaries.

Decisions need to be made on two types of boundaries: organizational and operational (WRI & WBCSD, 2000). The organizational boundaries determine which operations owned or controlled by the organization will be included in the inventory depending on the consolidation approach chosen by the organization (TCR, 2013). The organization can choose an equity share or control approach for its consolidation approach. When an organization uses the equity share approach, emissions are included from the assets for which the company has economic interests to the extent that the company has rights to the risks and rewards from the operation (WRI & WBCSD, 2000). The equity share is usually the same as the ownership percentage (WRI & WBCSD, 2000). When an organization uses the control approach, it would report 100% of the emissions for the operations in which it has control. The control approach to consolidation of the operations can be either operational or financial control (WRI & WBCSD, 2000).

Due to the large capital costs involved in building power plants, there are often several different companies that own a share of the plant. For example, the Conemaugh generation plant in Pennsylvania generated roughly 11,746,000 MWh of electricity in 2013 and emitted 10,601,387 metric tonnes of CO₂e. The plant is owned jointly by Constellation Energy Group (10.56%); Exelon Corp (20.72%); UGI Corp. (5.97%); Duquesne Generation LLC (3.83%); NRG Energy Inc. (19.72%); Public Service Enterprise Group Inc. (22.5%); and PPL Corp. (16.25%). This ownership information is taken from the Greenhouse Gas Reporting Program database that is available to the public on the EPA website.

Often one of the owner companies will run the day to day operations, so it will have operational control of the plant. For the Conemaugh plant, the daily operations are

controlled by GenOn Northeast Management Company, which is a subsidiary of NRG.

With that in mind, the consolidation approach used by NRG would greatly vary the GHG emissions it reports. If NRG used the equity share consolidation approach, it would only report 19.72% of the emissions or 2,090,594 metric tonnes of CO₂e. If NRG uses the control approach to consolidation, they would report the entire 10,601,387 metric tonnes of CO₂e in its GHG inventory because it has operational control of the facilities.

Emissions reported by using company control basis are either all emissions (100%) if the company controls the day to operations, or none of the emissions (0%) if the company does not have operation control.

The operational boundaries of a company also need to be defined to determine the company's GHG inventory. Setting the operational boundary will define the scope of the direct and indirect emissions that will be reported in the GHG inventory (WRI & WBCSD, 2000). Figure 3 was taken from the GHG Protocol and should help decide what emissions to include (WRI & WBCSD, 2000). We can see from this figure that there are Direct GHG emissions – scope 1 emissions, and there are Indirect GHG emissions – Scope 2 and 3. The different scopes were created to separately account for the two different emission types, to improve transparency and to provide adaptability for different types of organizations and climate policies (WBCSD, 2000). The scopes address the release of environmentally harmful chemicals (whether intentionally or unintentionally) and set requirements and categories that address accountability, tracking and reporting measures (WRI & WBCSD, 2000).

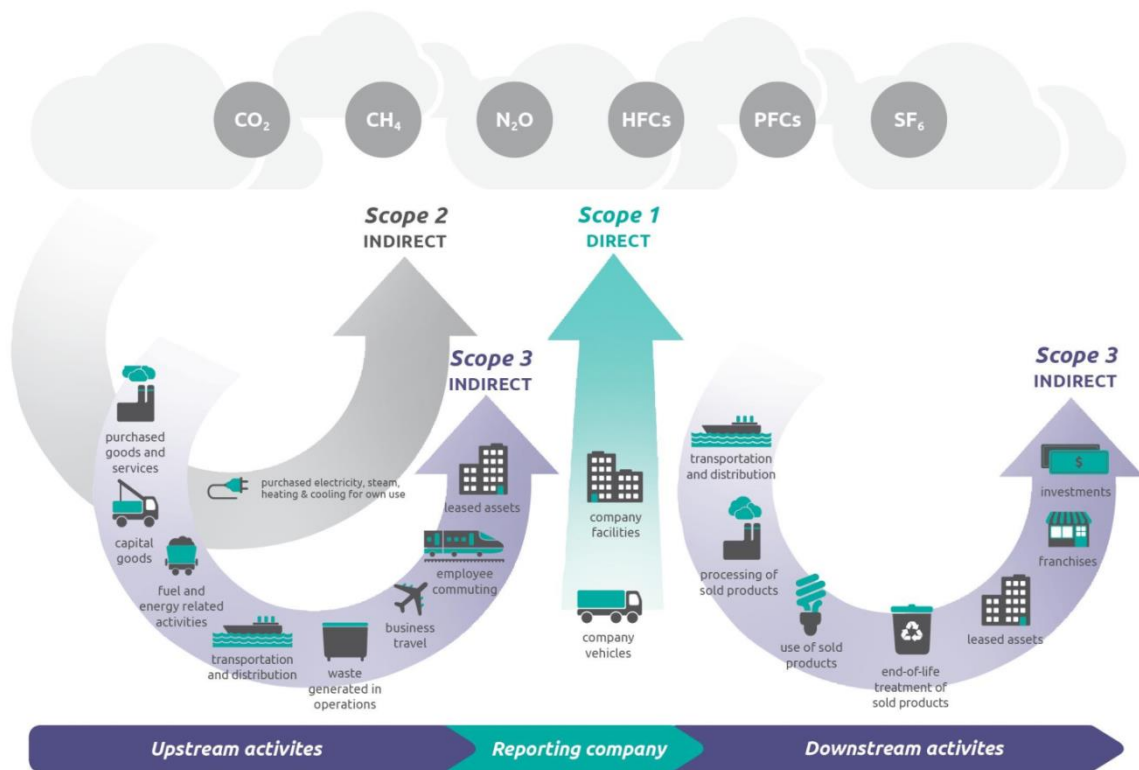


Figure 3. Scope diagram overview of GHG protocol scopes and emissions across the value chain.

The GHG Protocol requires that greenhouse gas emissions be categorized as direct or indirect (WRI & WBCSD, 2000). Companies report greenhouse gas emissions from sources they own or control as scope 1 emissions, which are also called direct emissions. These are emissions that are “from sources within the reporting entity’s organizational boundaries that are owned or controlled by the reporting entity, including stationary combustion emissions, mobile combustion emissions, process emissions, and fugitive emissions” (TCR, 2013). Direct emissions are the emissions within a company’s organizational boundary that come from sources that the company owns or controls, such as business travel in a company car or the combustion of fuel in the company’s boilers and furnaces (WRI & WBCSD, 2000). Other examples of direct emissions include the generation of electricity, steam or heat in equipment that is owned or controlled by the

reporting company, process manufacturing and leakage from refrigeration and air-conditioning units (EPA, 2016b).

For scope 1 “reasonableness” testing, only stationary combustion emissions from the company facilities were analyzed. These are emissions that result from the combustion of fossil fuels used in the production of electricity, steam, heat or power using equipment such as boilers and furnaces that are confined to a fixed location (TCR, 2013). The majority of the emissions generated in the electric power sector come from the stationary combustion of fossil fuels. Emission data similar to what was shown for the Conemaugh power plant was collected for the different power plants owned by the electric utilities chosen in this research study. Power plants that generate more than 25,000 metric tonnes of CO₂e are required to file their emissions per the mandatory Greenhouse Gas Reporting Program (GHGRP) with the implementation of 40 CFR Part 98. This emissions data is available through the EPA website under the GHGRP tab. I used these data to test the “reasonableness” of the emissions disclosed to make sure it met the minimum emissions that the company should be reporting as scope 1.

There are also Indirect GHG emissions – scope 2 and 3 depicted in Figure 3. Scope 2 is a special category of indirect emissions that accounts for the emissions that come from the generation of purchased or acquired electricity, heating, cooling and steam (WRI & WBCSD, 2000). These emissions often make up a significant percentage of any company’s inventory and provide an opportunity to reduce overall emissions. Most greenhouse gas programs require that companies track their scope 2 emissions by accounting for the emissions from their purchased electricity. These are “emissions that are a consequence of activities that take place within the organizational boundaries of the

reporting entity, but that occur at sources owned or controlled by another entity” (TCR, 2013).

Scope 2 “reasonableness” test encompassed Transmission and Distribution (T&D) losses that took place from electricity purchased by the electric utility from the grid or independent power producers. For this test, it was assumed that the companies in the study have purchased the extra electricity and transported it through their T&D system. As a result of these electricity purchases, the company will now have T&D losses that should be included in scope 2 emissions, since these losses are a portion of direct emissions from the “use” (loss) of purchased electricity (WRI & WBCSD, 2015).

Scope 3 emissions are also indirect emissions, but they are a result of activities within the value chain of the company. These scope 3 emissions occur at sources that are neither owned or controlled by the company (WRI & WBCSD, 2000). Per the GHG protocol corporate value chain, scope 3 emissions are optional in that companies do not have to report these emissions if the company so chooses (WRI & WBCSD, 2011). However, companies that want to be transparent usually disclose these emissions to their investors. Both upstream value chain emissions from material acquisition & pre-processing, as well as downstream value chain emissions from distribution & storage, use and end-of-life, are considered scope 3 emissions (WRI & WBCSD, 2011). Listed below are the 15 different categories of scope 3 emissions broken down between upstream emissions and downstream emissions (WRI & WBCSD, 2011).

Table 2. List of upstream or downstream scope 3 categories in the value chain.

Upstream scope 3 emissions	
	1. Purchased goods and services
	2. Capital goods
	3. Fuel- and energy-related activities (not included in scope 1 or scope 2)
	4. Upstream transportation and distribution
	5. Waste generated in operations
	6. Business travel
	7. Employee commuting
	8. Upstream leased assets
Downstream scope 3 emissions	
	9. Downstream transportation and distribution
	10. Processing of sold products
	11. Use of sold products
	12. End-of-life treatment of sold products
	13. Downstream leased assets
	14. Franchises
	15. Investments

Of particular importance is #3 – Fuel and energy related activities (not included in scope 1 and 2). This category includes the emissions from the generation of electricity purchased by the subsidiaries of the parent company that are then sold to end users or customers (WRI & WBCSD, 2011). Some utilities report these emissions under #11, Use of sold products. These emissions are reported by the utility company or the energy retailer and would include emissions from the generation of electricity, steam, heating, and cooling purchased by the subsidiary and then sold to their customers or other end users (WRI & WBCSD, 2011). Of particular importance is when utility companies purchase wholesale electricity from independent power producers that is then sold to the utility's customers (WRI & WBCSD, 2011). By purchasing wholesale electricity, the utility is removing emissions that would have normally been in scope 1 due to their own

generation of the electricity and moving them to scope 3 emissions when they purchase the electricity from another provider not affiliated with the company. Per Figure 4, electricity purchased by utility will be scope 3 emissions and the T&D losses from the purchased electricity are scope 2 emissions (WRI & WBCSD, 2015).

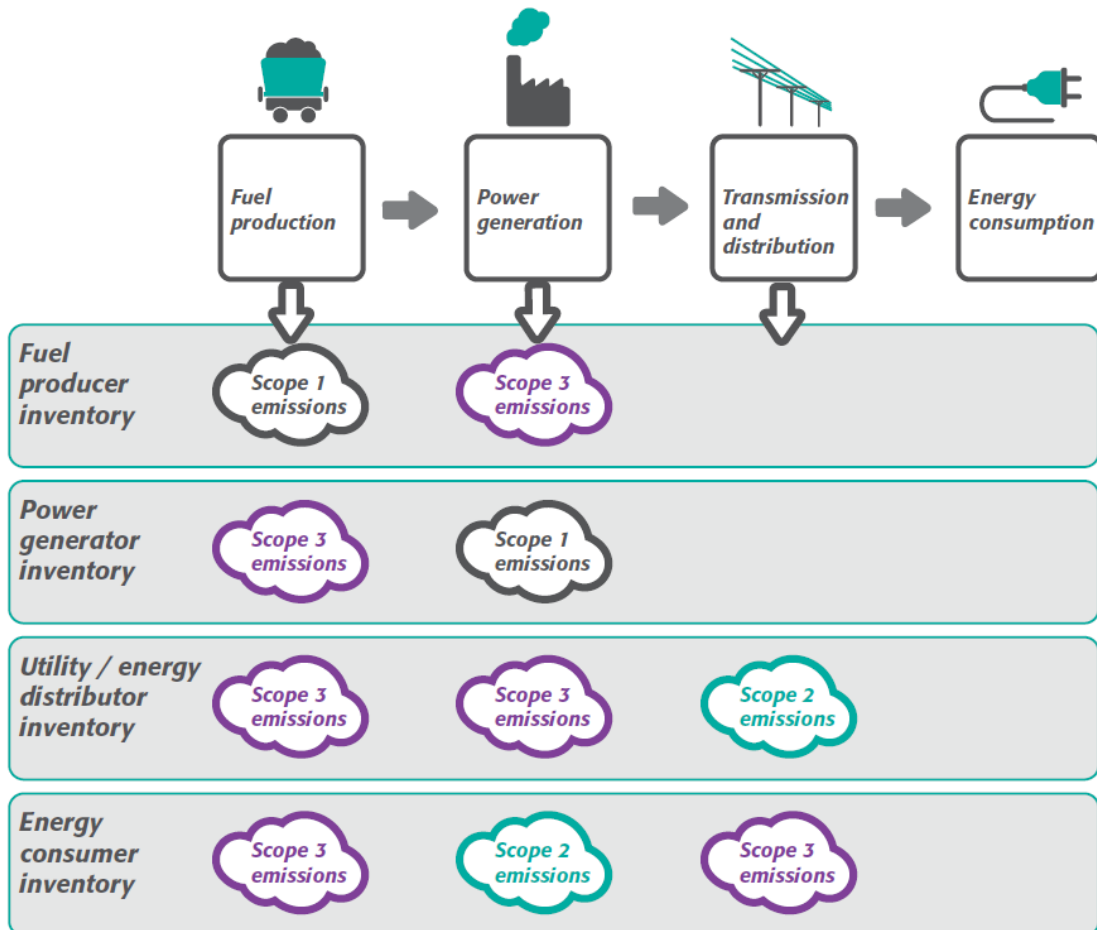


Figure 4. Accounting for electricity emissions throughout the supply system.

Greenhouse Gases

There are numerous standards used in computing GHG inventories, one of which is ISO 14064-1: 2006 Greenhouse gases – Part 1: “Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and

removals” (ISO, 2006). This standard defines greenhouse gases as – “gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth’s surface, the atmosphere, and clouds. Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆)” (ISO, 2006). In 2013, the GHG Corporate Standard Protocol was amended to align with the United Nations Framework Convention on Climate Change (UNFCCC). This amendment included the addition of nitrogen trifluoride (NF₃) in GHG inventories because it was considered a potent contributor to climate change and was mandated that it should be included in GHG inventories (WRI & WBCSD, 2013). For the most part NF₃ is used in the electronic industry, so it will not be included in this research.

When fossil fuels are burned to generate electricity, carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) emissions are released into the atmosphere. The majority of the emissions are carbon dioxide. Most GHG inventories disclosed in this study are in CO₂e which is carbon dioxide equivalent. TCR defines CO₂e as: “the universal unit for comparing emissions of different GHGs expressed in terms of the GWP (Global Warming Potential) of one unit of carbon dioxide” (TCR, 2013). The following section presents details of the activities associated with electricity generation.

Generation of Electricity

The generation of electricity can be very carbon intensive when fossil fuels are used as the source of energy in the process. In 2013, 68% of the electricity generated in the U.S. used coal, oil and natural gas (M.J. Bradley & Associates, 2015). Electric

companies rely on a variety of fuels to generate electricity and the generation fuel mix shifts due to supply, demand, fuel prices and regulatory initiatives (Edison Electric Institute, 2015b). I will only examine electricity generated from the use of fossil fuels, because the generation of nuclear, hydro and renewable power does not have greenhouse gases associated with their processes. The generation of electricity and delivering it to the customer is a multifaceted task. It can be broken into six different steps, as seen in Figure 5 (Edison Electric Institute, 2015a), by following the flow of electrons from generation to use.

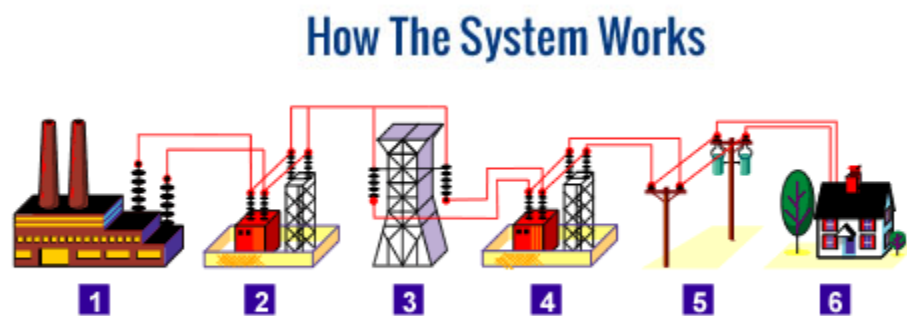


Figure 5. How electricity travels from the power plant to the customer. (Picture taken from Edison Electric Institute website. Explanations taken from Edison Electric Institute and EPA.)

1. Power Plant – this is where the electricity generation process takes place.

Electricity is generated when fossil fuels (coal, natural gas and oil) are burned in the boiler to heat water into steam. Under high pressure, the steam turns the blades of a turbine which in turn spins a generator. Greenhouse gases are a byproduct of the electrical generation when fossil fuels are used in the process.

Most of the electric generation sector's GHG emissions come from this stationary combustion of these fossil fuels.

2. Step-up substation near the generator – this is where the voltage is increased to 69,000 – 765,000 volts in order to travel to the generator’s customers. The voltage chosen is dependent on the distance the electricity needs to travel and the amount of electricity that is desired.
3. Transmission system – electricity enters this system of heavy cables that are strung between the tall towers. The electricity is traveling nearly the speed of light. The transmission system includes the lines that link the electricity generator to the distributors, transporting electricity to local electric companies. The electricity encounters a certain amount of resistance while traveling on the transmission lines that translates into line losses. Typical line losses range from 5.76% in the western section of the U.S. to 9.17% in the eastern section of the U.S. (EPA, 2015b). The transmission grid within the U.S. consists of approximately 200,000 miles of high-voltage lines. The transmission system has redundancy built into it to ensure that there are alternative power paths for emergencies.
4. Step-down transformer located in a substation near the customer. Here the voltage of the electricity is reduced to enable it to be carried on smaller cables.
5. Distribution lines then carry the electricity to the customer. The voltage of the electricity is reduced by small transformers that are on the poles or underground. The voltage is reduced to 120-240 volts for residential customers. In addition to the substations, the distribution system includes wires, poles, metering, billing and related support systems involved in the retail side of electricity delivery.

6. Customer – there are three major types of electrical customers: residential (35.6% of sales), commercial (38.2% of sales) and industrial (25.9% of sales) (Edison Electric Institute, 2015b).

The Federal Energy Regulatory Commission (FERC) regulates the interstate transmission of electricity, natural gas, and oil in the United States (FERC, 2015b). The sale of electricity can take place in either a retail or wholesale market. Retail sales are made to consumers, while wholesale market sales usually involve the sale of electricity to another electric utility or electricity trader before it makes its way to the consumer (FERC, 2015a). FERC has jurisdiction over the wholesale electricity markets and its responsibilities include authorizing the sale of electricity at market-based rates (FERC, 2015a).

The electricity market makeup varies in different regions in the United States. The traditional wholesale markets for electricity exist in the southeast, southwest and northwest sections of the country (FERC, 2015b). In these regions, the utilities are usually vertically integrated, which means that they own their own generation, transmission and distribution systems to provide electricity to their customers (FERC, 2015b). Most of the remaining areas of the country have, at certain times, constrained transmission systems and will trade electricity through bilateral transactions and power pool agreements (FERC, 2015b). The Commission at FERC developed the Independent System Operators (ISO) undertaking as a unique way for an independent regulated entity to manage the congestion and existing tight power pools in a non-discriminatory manner, as well as, help ensure the safety and reliability of the system for those involved in the delivery of electric power (PSEG, 2013) (FERC, 2015b). Congestion in the system occurs when the capacity of the available transmission line is maxed or exceeded due to

electric power flowing through the lines (PSEG, 2013). During this condition, alternative power lines are used, including local generators near the load (PSEG, 2013).

Each of the different ISO systems within the U.S. and Canada are shown in Figure 6 (FERC, 2015b). ISOs are responsible for dispatching electricity when there are transmission constraints or congestion within their area of control. Congestion occurs when there isn't enough transmission capacity for the lowest cost electrical generators to be selected to provide the needed power (FERC, 2015a). In order to meet demand, the ISO will select more expensive electrical generators from different locations on the grid (FERC, 2015a).

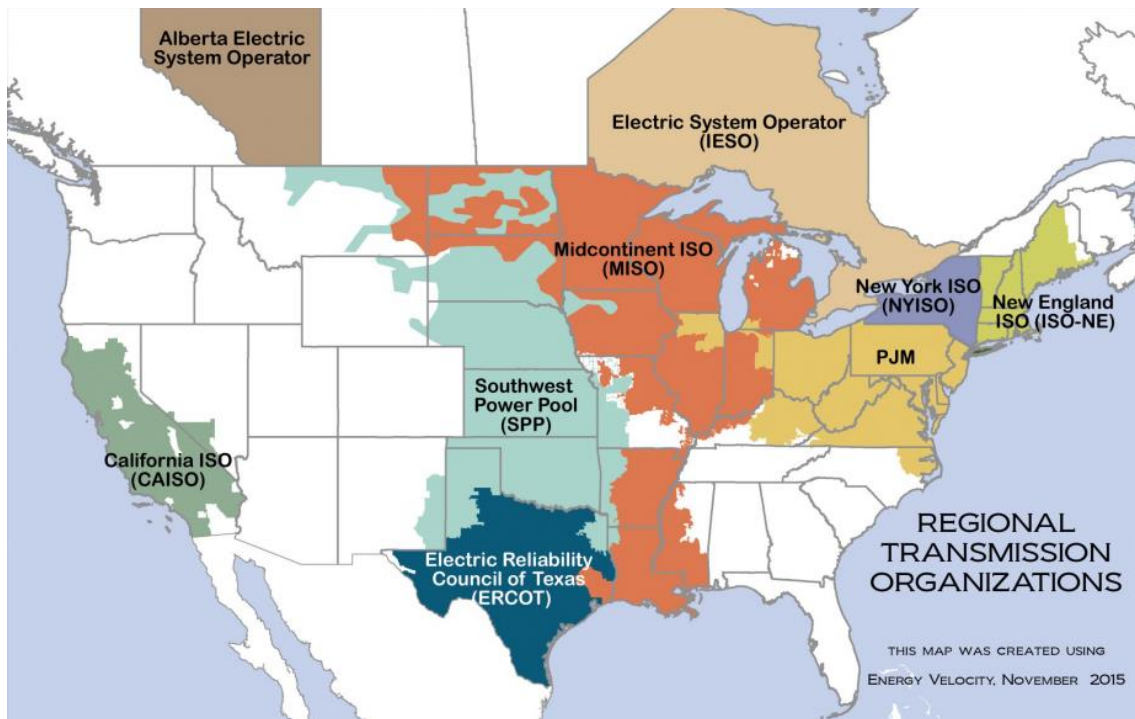


Figure 6. Map of the United States depicting the FERC Independent System Operators in the United States and Canada.

Reasonableness Test

Auditors have many tools in their toolbox that they can use when conducting audits, whether they are financial, compliance or performance audits. The use of analytical procedures can benefit any audit, if they are part of a planned audit strategy or risk assessment. Analytical procedures can be tailored for each individual audit and can often be done with data that is readily available. Computations can be done using financial or operational data to predict a balance of a particular account or whether the reported data seems “reasonable”.

There are several different types of analytical procedures that auditors perform including reconciliations, reasonableness tests and corroborating procedures. Most people are familiar with reconciliations, as they probably perform one monthly on their checking accounts. Reasonableness tests are based on averages and estimates of the data in question. Corroborating procedures may involve comparisons of the data and ratio analysis.

As Larry Perry, CPA put it, analytical procedures are more than just numerically based procedures; they are an extension of an auditor’s thought process (Perry, 2014). Perry goes on to say that “challenging financial information or the lack of such information that appears unusual; maintaining a positive, healthy skepticism when considering responses to inquiries of reporting entity personnel; and searching for the cause of a problem beyond its symptoms are all examples of analytical thinking” (Perry, 2014).

It is the lack of “reasonable” scope 2 emissions that was a flag, and as an auditor, invoked my “professional” skepticism of the company’s disclosed data. The “reasonableness” tests included in this study looked at the emissions that are required to

be filed with the EPA and see how they compared to the scope 1 emissions disclosed by the company. It also included testing for scope 2 T&D losses calculated from purchased electricity and how these emissions compared to the scope 2 emissions disclosed by the company. The purchased electricity also has emissions associated with them and should be included in the company's scope 3 emissions.

Legislation to Protect Investors

Requiring public companies to disclose financial information and their risks is nothing new in the United States. Requirements for this type of disclosure can be traced back to the Securities Act of 1933 and the Securities Exchange Act of 1934 (SEC, 2013). These acts were passed to protect the investor after what happened in the stock market crash of October 1929 and to restore the public's faith in the capital markets.

One of the first investigations of companies misleading the investors in climate change risk disclosures took place in 2007. The Attorney General of New York at the time, Andrew M. Cuomo, issued subpoenas to 5 large energy companies including AES Corporation, Dominion, Dynegy, Peabody Energy and Xcel Energy (Barringer & Hakim, 2007). Mr. Cuomo investigated whether these companies were disclosing to their investors the economic risk and environmental concerns associated with the building of new coal-fired power plants. Accompanying the subpoenas were letters stating that "Selective disclosure of favorable information or omission of unfavorable information concerning climate change is misleading" (Barringer & Hakim, 2007).

Since then, both the Sarbanes-Oxley Act of 2002 and the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 were passed to further enhance the corporate financial disclosures and transparency (SEC, 2013). Federal securities law

required that all publically traded companies disclose information that would enable a reasonable investor to make informed investment decisions. These disclosures should include financial information, as well as, nonfinancial information such as sustainability issues, including GHG emissions.

To help public companies determine what material sustainability information should be disclosed in their annual 10-K statements filed with the SEC, the Sustainability Accounting Standards Board (SASB) has issued standards to help in this area. SASB has developed industry-specific metrics that allowed comparability in corporate reporting. Take for example the very carbon intensive electric utilities; SASB has identified 9 material sustainability topics that should be disclosed in the public company's SEC filings, the first of which is Greenhouse Gas Emissions & Energy Resource Planning (SASB, 2015).

Investors and asset managers have relied for decades on the information disclosed by publicly traded companies in their annual 10-K reports filed with the SEC. It is within these reports that the companies not only disclose their financial performance for the year, but they also disclose the risks that are material to their operations and future performance. For the utilities sector, climate change is a material risk (SASB, 2015). These risks should be addressed in the annual 10-K, along with all the other risks depicted by SASB that are material to the company in a carbon constrained economy.

Specific Legislation for Utilities

The electric utility industry is a highly regulated sector. FERC and EPA are some of major regulatory agencies in this area. As mentioned earlier, FERC regulates the interstate transmission of electricity, natural gas, and oil in the U.S. As a result, the

utilities are required to file a FERC Annual Report (FERC Form No. 1) disclosing financial information for the past year. The EPA also requires the mandatory reporting annually of GHG from sources that emit 25,000 metric tonnes or more of CO₂e in a year under 40 CFR Part 98 (EPA, 2016f). As a result of all the legislation on the electric generation sector and the requirement to file annual reports with both of these entities, there is a tremendous amount of publicly available data for this sector. Much of the data used in this research came from FERC's and the EPA's databases.

A short description of the other legislation affecting the electric generation sector can be found in Appendix 2.

Previous Research on Climate Risk Disclosure

In June of 2009, a study was released titled *Climate Risk Disclosure in SEC Filings* (Young, Suarez, & Gladman, 2009). Ceres and the Environmental Defense Fund (EDF) commissioned the Corporate Library to evaluate the extent to which companies were disclosing climate risks in the annual 10-K reports to the SEC for the year ending December 31, 2007. This report looked at 100 companies within the following sectors: Electric Utilities, Coal, Oil and Gas, Transportation and Insurance. The research used the Global Framework for Climate Risk Disclosure to evaluate the company's 10-K disclosure. There were three main areas the study focused on: 1) emissions and climate change positions, 2) risk assessment, and 3) actions to address climate risks and opportunities (Young et al., 2009).

Within the electric utilities sector the report noted that the companies' disclosure was widespread, but that it was of minimal use. There were 26 companies included in their study. Disclosure of emissions and climate change results can be found in Table 3

(Young et al., 2009). Note, none of the companies received a “Fair” rating for disclosure of emissions and climate change. Only three of the companies, or 12%, climate risk assessment disclosures were considered “Fair” and only two of the companies, or 8%, were ranked “Fair” for their disclosures on actions to address climate change (Young et al., 2009). Even with these deficient disclosures, the electric utilities sector scored higher than the other four sectors included in the study (Young et al., 2009).

The evaluation key for company disclosure (Table 3) is:

None:	Climate risk is not mentioned at all in annual filing.
Poor:	Climate risk is discussed, but is not analyzed in terms of its impact on the company’s business.
Limited:	Annual filing includes limited discussions or analyses of climate risk as it applies to the company’s business.
Fair:	Annual filing includes fuller discussions or analyses of the impact of climate risk on the company’s business, but disclosure still does not meet the requirements of the Global Framework for Climate Risk Disclosure.

*For Fiscal Year 2007

Table 3. Climate risk disclosure for electric utilities from annual SEC filings 2008.

	Disclosure of Emissions and Climate Change	Disclosure of Risk Assessment	Disclosure of Actions to Address Climate Risk
AES Corp.	Limited	Fair	Limited
Ameren Corporation	Poor	Limited	Limited
American Electric Power Company, Inc.	Poor	Limited	Poor
Berkshire Hathaway	Poor	Poor	None
Calpine Corporation	Limited	Limited	Limited
CenterPoint Energy, Inc.	Poor	Poor	None
Consolidated Edison, Inc.	Limited	Poor	Poor
Constellation Energy Group, Inc.	Poor	Poor	Poor
Dominion Resources, Inc.	Poor	Limited	Limited
DTE Energy Company	None	Poor	None
Duke Energy Corporation	Limited	Limited	Limited
Edison International	Poor	Limited	Limited
Entergy Corporation	Limited	Limited	None
Exelon Corporation	Limited	Limited	Limited
FirstEnergy Corp.	None	Limited	None
FPL Group, Inc.	None	Poor	Fair
Integrus Energy Group, Inc.	Poor	Poor	None
National Grid	Limited	Poor	Limited
Pepco Holdings, Inc.	Poor	Poor	Poor
PG&E Corp.	Poor	Fair	Fair
Progress Energy, Inc.	Poor	Limited	Poor
Public Service Enterprise Group Incorporated	Limited	Limited	Poor
Reliant Energy, Inc.	Poor	Limited	Poor
Sempra Energy	Poor	Poor	None
Southern Company	None	Limited	Poor
Xcel Energy	Limited	Fair	Limited

Numerous groups including the Subcommittee on Securities, Insurance, and Investment of the Senate, as well as Ceres and the Environmental Defense Fund, had contacted the Securities and Exchange Commission (SEC), to increase corporate disclosure of climate-related risks. After careful consideration of the issues, the SEC released its Commission Guidance Regarding Disclosure related to Climate Change (Guidance) to be effective February 8, 2010 (SEC, 2010). The purpose of this guidance was to aid SEC registrants in preparing their disclosure obligations that were already required under the existing federal securities laws and regulations (SEC, 2010). In this interpretative guidance, the SEC detailed four different areas that registrants might need to consider in disclosing the risks of climate change (SEC, 2010). Table 4 lists the four areas and examples of potential disclosure items (Coburn & Cook, 2014).

Table 4. SEC interpretive guidance related to climate change and examples of potential disclosure items.

Section of Guidance	Examples of Potential Disclosure Items
Impact of Legislation & Regulation	<ul style="list-style-type: none"> • Cost to purchase credits in a cap and trade system • Costs to improve facilities to comply with regulatory limits of a cap and trade system • Changes to profit/loss from changed demand for goods and services
International Accords	
Indirect Consequences of Regulation or Business Trends	<ul style="list-style-type: none"> • Decreased demands for goods with significant GHG emissions, or increased demand for those with lower emissions • Increased demand for energy from alternative energy sources • Decreased demand for services related to fossil fuels, such as drilling services or equipment maintenance
Physical Impacts	<ul style="list-style-type: none"> • Disruption of manufacturing or transport for registrants with operations on coastlines • Indirect impacts to major customers or suppliers from severe weather, such as hurricanes or floods • Increased claims and liabilities for insurance & reinsurance companies • Decreased agricultural production due to drought or other weather changes

Ceres did an analysis of the 2010 - 2013 10-K filings to see if the Guidance had any effect on the climate change disclosures. Their study, released February 2014, found that a large number of the filings for the S & P 500, 41%, did not contain any climate related disclosures (Coburn & Cook, 2014). In their report, *Cool Response: The SEC and Corporate Climate Change Reporting – SEC Climate Guidance & S&P Reporting: 2010-2013*, Ceres found that corporate climate reporting had increased marginally following the SEC's issuance of the Interpretative Guidance (Coburn & Cook, 2014). Most of the disclosures were boilerplates that provided very limited data to investors on climate change risks (Coburn & Cook, 2014). The study found that for the 35 Electric & Gas Utilities/Coal companies listed in the S&P 500, all of them had included some type of climate change disclosure in their 2013 SEC filings (Coburn & Cook, 2014). Ceres now has a SEC Climate Search Tool on their website that enables the user to search the SEC filings to see if different companies have mentioned climate change issues in the 10-K filings (Ceres, 2016b).

This Ceres' study also looked at the number of SEC comment letters that were sent out from 2010 – 2013 that mentioned climate risk. As you can see in Table 5, only 52 comment letters were sent in this time frame that dealt with climate risk (Coburn & Cook, 2014). And of these comment letters, the carbon intensive and high-risk sectors did not receive a greater proportion of the letters (Coburn & Cook, 2014). The study also pointed out that these SEC comment letters were quite limited in their scope; asking the companies whether they had considered using the Guidance, rather than commenting on their climate risk disclosures for regulatory or physical risks (Coburn & Cook, 2014). It appears that there hasn't been much SEC activity associated with the distribution of

climate related disclosures recently, with three comment letters issued in 2012 and no letters issued in 2013 Coburn & Cook, 2014).

Table 5. SEC comment letters on climate risk by industry: 2010 -2013.

Industry	Number of Letters Sent to Companies & Asset Managers			
	2010	2011	2012	2013
Total Comment Letters for Year	38	11	3	0
Asset Manager	21	6		
'Blank Check' Company	1			
Electric & Gas Utilities	3			
Insurance Services	3	1	1	
Manufacturing	1	1		
Mining	2			
Oil & Gas	2			
Real Estate Finance/Property Development	1	1	2	
Renewable Fuels	2	1		
Services (Personal Services)	2			
Services (Water Utility)		1		

Dissatisfaction with GHG Reporting Schemes

Investors have complained about the difficulties in the comparability of carbon data among companies. There are numerous reasons including the number of different GHG reporting schemes that are being used by companies to report their emissions. All these different schemes vary in terms of the objectives they are trying to achieve. These schemes are broken down into “Building Blocks” in one of the Organization for Economic Co-operation and Development’s (OECD) Working Papers on International Investment as seen in Figure 7 (Kauffmann, Less, & Teichmann, 2012).

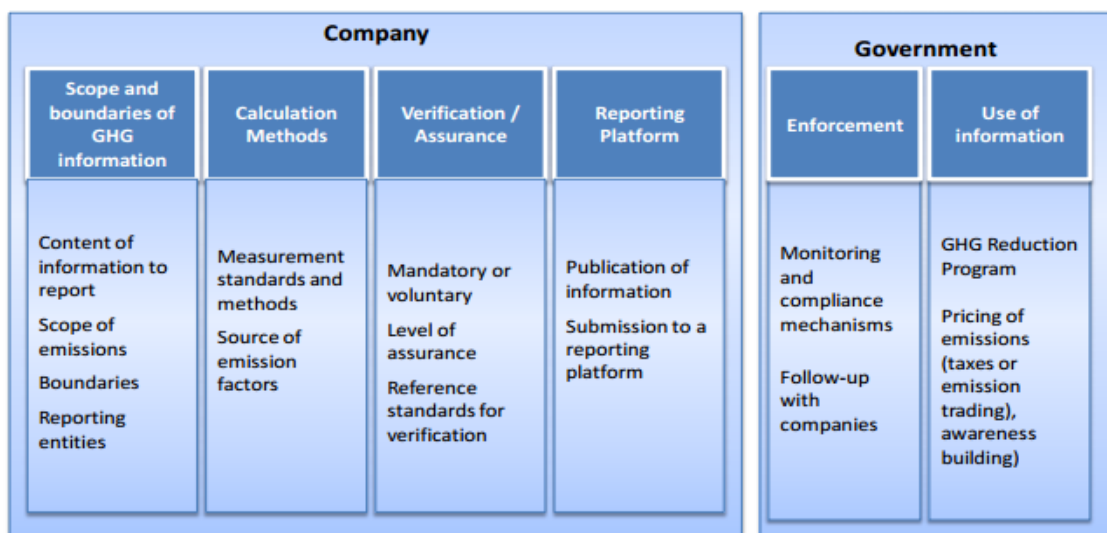


Figure 7. Building blocks within the different GHG reporting schemes.

The OECD paper illustrates that even though all the schemes are reporting GHG emissions, there may be variations in the “building blocks” found in each of the different climate change reporting schemes (Kauffmann et al., 2012). For example, in the EPA’s Mandatory reporting program, GHGRP has a threshold of 25,000 MT CO₂e before an entity has to report that facility. On the other hand, TCR wants every facility reported, no matter the size, and requires 3rd party verification/assurance of the company’s emissions. The EPA GHGRP does not require 3rd party verification/assurance because it was designed using a centralized verification system to check the data used in the calculation of emissions (EPA, 2016a). There can be differences in the boundaries used, scope of emissions reported, and source of emission factors to mention just a few differences that can occur in the “building blocks” (Kauffmann et al., 2012).

The GHGRP program does have a built in process that ensures the data the entity submits to the EPA is accurate, complete and consistent (EPA, 2011). According to the EPA, to help prevent errors, there are over 9,000 pre-submittal checks and 3,500 post-

submittal checks done on the data (EPA, 2016a). The EPA does require the reporter to self-certify emissions data when submitted as seen in Figure 8 (EPA, 2011).

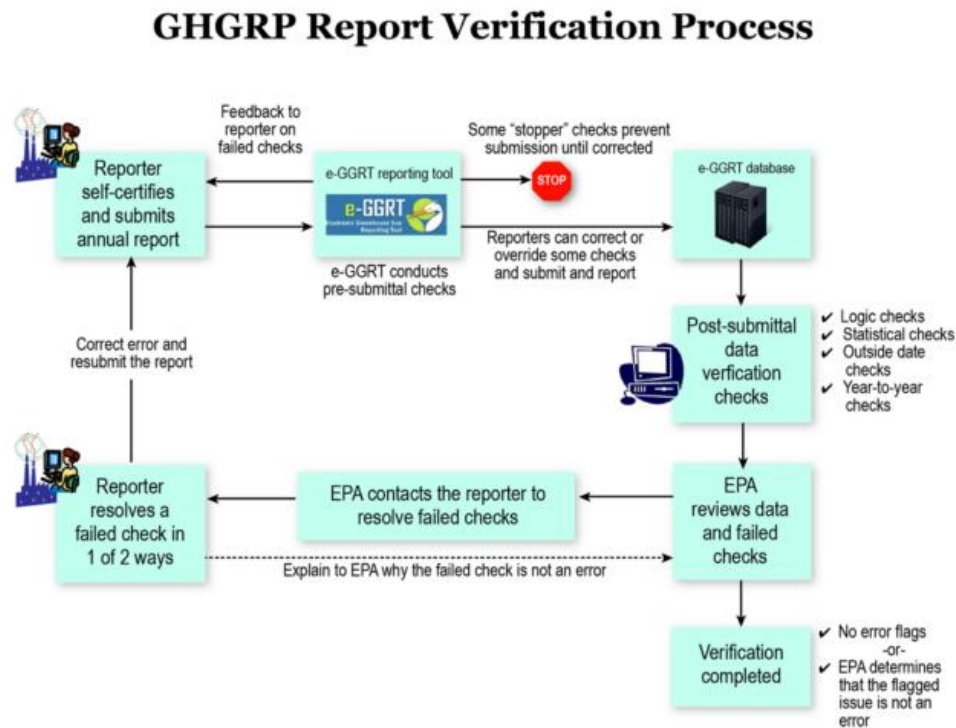


Figure 8. Report verification process within the GHGRP.

When the data submitted by the reporter doesn't pass one of these checks, the report is flagged. The report can't be submitted until all of these flags are cleared (EPA, 2011). The quality of the reporting has been improving over the last few years, with 46% of the initial reports having flags in them. As of this writing, about 20% of the reports have flags (EPA, 2016a). In 2013, there were 1,570 total reporters in the power plant sector for the GHGRP (EPA, 2013). Of these reporters, nearly 80% of the emissions are monitored and reported from CEMS data (EPA, 2013)

The Climate Disclosure Standards Board (CDSB) mentions in their publication *The case for consistency in corporate climate change-related reporting*, that climate

change-related reporting is one of the most developed areas of non-financial corporate reporting (CDSB, 2012). However, the report also indicate that due to the number and variety of schemes used for climate change disclosures, consistency between the different schemes is tough to achieve and that variations have developed (CDSB, 2012).

This inconsistency is highlighted when CDSB looked at the Global 500 companies that responded to the 2011 CDP questionnaire and reported results as seen in Table 6 (CDSB, 2012).

Table 6. Breakdown of organization boundary approach used in CDP responses for 2011.

Organizational boundary approach	Number of companies
Equity share	17
Financial control	103
Operational control	244
Other	38
Total	402

In May 2014, an investor survey was released by PricewaterhouseCoopers (PwC) titled *Sustainability goes mainstream: Insights into investor views*. Eighty two percent of the respondents indicated they have considered “climate change and/or resource scarcity” in the last 12 months and 87% expect to consider “climate change and/or resource scarcity” in the next 3 years (PwC, 2014). The PwC survey results also indicated that investors strongly believe companies should periodically assess their risks to climate change. Eighty four percent of the respondents believed that the companies should periodically assess their climate change physical risks, such as risks from “heat waves, storm intensity, water shortages, other physical impacts of climate change” (PwC, 2014). The survey also found that the investors’ reasons for considering sustainability issues

were varied including: 75% risk mitigation, 55% avoiding firms with unethical conduct and 52% enhancing performance (PwC, 2014).

This same survey by PwC also mentioned that most investors, both in the US and globally, are dissatisfied with the “current level of corporate disclosure regarding matters relevant to climate change, resource scarcity, social corporate responsibility, and good citizenship” (PwC, 2014). When the institutional investors were contacted, 82% of them were dissatisfied with how companies disclose in financial terms their ESG risks and opportunities (PwC, 2015b). The institutional investors were also dissatisfied with the companies’ disclosures concerning the relevance and implications of their ESG risks (PwC, 2015b). The PwC survey also highlighted the need for common standards to assess the materiality of environmental and social issues (PwC, 2014). In the United States, the Sustainability Accounting Standards Board (SASB) has been working to design standards in this area. The standards designed by SASB are for the voluntary disclosure of material sustainability information in SEC filings such as the company’s annual 10-K (PwC, 2015a).

Research was done by Rory Sullivan and Andy Gouldson to determine if voluntary carbon reporting was meeting investors’ needs (Sullivan & Gouldson, 2012). Their case was based on the UK retail sector, but the results can be translated to other sectors globally. They indicate that “investors have consistently criticized companies for not providing information that can be readily used in investment decision making. Companies, in turn have criticized investors for not utilizing the information that they provide” (Sullivan & Gouldson, 2012). The authors state that there is no standard way investors integrate climate change into the investment processes and decision making (Sullivan & Gouldson, 2012). Their prior research concluded that investors are often

more interested in quantitative data rather than qualitative data (Sullivan & Gouldson, 2012).

Sullivan's & Gouldson's study also showed that there are two areas limiting the investor's ability to assess corporate climate change performance given the current type of company disclosures (Sullivan & Gouldson, 2012). The first finding relates to the ability to compare performance between two different companies. They found that it is very difficult to make a robust comparison of performance of the companies in their study, or to develop a robust benchmark (or ranking) of the companies' performance, due to the use of different reporting standards, scopes drawn differently and the significant gaps and inconsistencies in the data disclosed (Sullivan & Gouldson, 2012). This finding echoes investor complaints about the difficulties they encounter comparing companies while making investment decisions (Sullivan & Gouldson, 2012).

Sullivan's and Gouldson's second finding was twofold. They found it was possible to use the disclosed data to make conclusions concerning the financial significance of the direct or operations emissions reported by the companies (Sullivan & Gouldson, 2012). It was, however, virtually impossible to have the same confidence in assessing the significance of the emissions associated with the company's supply and value chains (Sullivan & Gouldson, 2012). It is much harder for investors to assess the significance of the risks the emissions pose in the company's supply and value chains than it is to assess the risks in direct or operation emissions of the company (Sullivan & Gouldson, 2012).

KPMG, in their report titled *Currents of change*, recently assessed the quality of the corporate responsibility (CR) reports from some of the largest global companies (KPMG, 2015). They looked at the CR reports from mid-2014 to mid-2015 for the

world's 250 largest companies by revenue (G250), paying particular attention to the carbon information disclosed by these firms in their CR reports and their annual financial reports (KPMG, 2015). In KPMG's report, they assessed the quality of the data disclosed in the CR reports using their own devised scoring methodology (KPMG, 2015). Of the G250 companies included in the study, 33% were from the Americas and 5% were from the utility sector including electricity, gas, water and multi-utilities (KPMG, 2015).

Some of the findings in report include:

- “There is a lack of consistency in the carbon information that the world's largest companies publish in their annual financial and/or CR reports. This makes it almost impossible to accurately compare one company's carbon performance with another's (KPMG, 2015).”
- “Companies in the US and Asia Pacific countries including China are the least likely to report on carbon; European companies are the most likely to do so (KPMG, 2015).”
- “Just over half of companies that report on carbon include carbon data in their annual financial or integrated reports (KPMG, 2015).”
- “62 percent of carbon reporters invest in independent assurance, in line with global rates of assurance for other CR information in reporting (KPMG, 2015).”
- “Nine of the 15 sectors surveyed have a global CR reporting rate of 75 percent or higher. The sectors leading the way with CR reporting continue to be the heavy and traditionally polluting industries, including mining and utilities (KPMG, 2015).”

With more than 90% of the G250 preparing CR reports and appearing to address climate change, it would seem that they were ready for the future low-carbon economy (KPMG, 2015). But as KPMG investigated further, what emerged was an entirely different picture. Their analysis revealed “fragmented, inconsistent approaches and patchy transparency” (KPMG, 2015). They found that key information was missing from many of the annual financial reports, as well as the CR reports (KPMG, 2015). The information that the companies chose to disclose varied widely between the different industry sectors and between different geographies (KPMG, 2015). KPMG also found it virtually impossible to accurately compare carbon performance between companies within the same industrial sector (KPMG, 2015). As Wim Bartels, KPMG’s Global Head of Sustainability Reporting & Assurance, put it: “Corporate carbon reporting needs an overhaul” (KPMG, 2015).

Research Questions, Hypotheses and Specific Aims

The primary research questions to be evaluated: Are the GHG emissions voluntarily disclosed by these electric utilities “reasonable” and present a true picture of their climate friendliness? Do the GHG disclosed emissions show results similar to what the KPMG analysis found “fragmented, inconsistent approaches and patchy transparency” (KPMG, 2015)? Are the scope 1 emissions voluntarily disclosed comparable to the available regulatory data? Do scope 2 emissions include the company’s transmission & distribution losses (T&D) from purchased electricity? Do scope 3 emissions include electricity purchased by the company from merchant power plants or from transmission systems?

My research tested the following hypotheses:

H1: The scope 1 emissions disclosed by the electric utilities are equal to the emissions that are required to be reported to the EPA as a result of the Greenhouse Gas Reporting Program (GHGRP) with the implementation of 40 CFR Part 98.

H2: The scope 2 emissions disclosed by the electric utilities are equal to the emissions from calculated T&D losses for the company.

H3: The scope 3 emissions disclosed by the electric utilities are equal to the emissions from purchased electricity used to supply customers.

To address these hypotheses, specific research aims were developed to determine:

1. If an entity's scope 1 disclosed emissions were "reasonable"? Are the emissions disclosed in the company's CSR report greater than or equal to the stationary combustion emissions reported to the GHGRP?
2. If an entity's stationary combustion emissions reported in the M.J. Bradley & Associate (2015) Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States (Benchmarking) report were a "reality check" for the emissions reported by the company in its CSR report for scope 1? Were the disclosed emissions greater than or equal to the Benchmarking Air Emissions report? (The emissions data used in the most recent Benchmarking report, published July 2015, are from 2013. Therefore comparisons of emissions across the datasets will be of 2013 emissions.)

3. If the emission from Best Data (GHGRP dataset combined with the peaking emissions from the Benchmarking dataset) are less than the comparison groups?

These comparison groups are:

- a. CSR emissions.
 - b. SEC 10-K emissions.
 - c. CDP emissions.
4. If an entity's disclosed scope 2 emissions were reasonable? Based on the utility's purchased electricity amounts, are they including T&D losses when disclosing scope 2?
 5. If an entity's disclosed scope 3 emissions were reasonable? Based on the utility's purchased electricity amounts, are these emissions included in scope 3?

Chapter II

Research Methods and Design

The methodology employed for this research focused on determining if the GHG emissions data disclosed by the different electric generating utilities was “reasonable”. Testing was done to determine if the emissions that these companies voluntarily disclosed in their annual 10-K statements, sustainability/CSR reports and the CDP climate change questionnaire were “reasonable” based on data that is publicly available from regulatory and voluntary databases. This data was collected for twenty-nine U.S. large and mid-size electric utilities that are the publicly traded parent companies, many of the same companies that were analyzed in the *Climate Risk Disclosure in SEC Filings* study seen in Table 3 on page 27. The data was used to predict the minimum scope 1, 2 and 3 emissions that the utilities should be disclosing to give an accurate picture of the carbon intensiveness of the company and its “climate friendliness”.

Investors are using this type of ESG data to increase alpha and to determine the climate change risks of their portfolios. The decision was made to try and collect as much of the information from publicly available databases as possible, so that an investor could repeat the research if they wanted to look at a particular electric utility. It is tedious work, but it can be done. Although this research has an investor’s focus, no attempt will be made to give advice on which is the best utility to invest in.

The type of fuel used for the generation of electricity will affect the amount of GHG emissions produced. Electricity produced by nuclear, hydro or renewable energy does not have any GHG emissions associated with its generation. Table 7, found on page

47, shows the total MWh generated by each of the electric utilities. This amount is further broken down into the MWh produced using fossil fuel and then further refined to MWh generated by coal as fuel. Those utilities that have a large percentage of their generation from nuclear power will show lower MWh generated by fossil fuels and coal, as well as lower emissions overall.

GHG emissions for electric utilities are predominately scope 1 direct emissions from stationary combustion. It is relatively easy to access scope 1 emissions from stationary combustion within the U.S. regulatory databases. The challenge comes in assigning the power plant ownership which is necessary to determine the emissions at a facility level. Electric utility companies not only generate electricity, but they often purchase electricity from the grid or from other independent power producers. This purchased electricity is then resold to customers through the company's T&D system. A portion of this purchased electricity is lost in the T&D system and this loss needs to be accounted for as scope 2 T&D losses. Many of the standards used in calculating emissions, including the GHG Protocol, require that the company at a minimum separately account for and report scope 1 and 2 emissions (WRI & WBCSD, 2000). Under the GHG Protocol, Scope 3 Indirect GHG emissions are an optional reporting category (WRI & WBCSD, 2000). Emissions from upstream scope 3 fuel and energy-related activities (#3) that are not included in scope 1 or scope 2 will also be include in this study due to the purchased electricity moving GHG emissions from scope 1 to scope 3. Testing the "reasonableness" of one type of emission from each of scopes 1, 2 & 3 emissions, will give insight into the company's transparency and whether they are calculating the emissions accurately. Analysis of the data will also reveal whether the company is following the remaining GHG accounting and reporting principles of

completeness, consistency and relevance (WRI & WBCSD, 2000). More details about each of the scopes can be found in the following sections.

Scope 1 Emissions

There are many nuances in the electric generation sector that make this sector challenging. One such nuance is the plant ownership due to the very capital intensive nature of the business. One generation plant can have multiple owners/investors as pointed out in the ownership of the Conemaugh plant which had 7 different owners. As a result of this co-ownership, the revenue, expenses, generation amount and even emissions need to be prorated by the ownership percentage. Ownership of the plants is constantly changing as the different companies' goals and expectations change in a low carbon economy. Presently there is a movement to divest or close inefficient coal fired generation plants, so the ownership of these plants will probably change again in the coming years.

With this being said, it was important to find a reputable list of plants with the correct ownership percentages incorporated. M.J. Bradley & Associates' (MJB) *Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States* (Benchmarking), published in July 2015, provided some of the GHG emissions, generation totals and ownership information that has been used in the author's research (M.J. Bradley & Associates, 2015). It has been an invaluable resource throughout this study. Data for the Benchmarking report has been taken from various sources including: EPA Air Markets Program (AMP); EPA Toxic Release Inventory (TRI); EIA Forms 923 Power Plant Databases (2013); EIA Form 860 Annual Electric Generator Report and the

EPA U.S. Inventory of Greenhouse Gas Emissions and Sinks (2015) (M.J. Bradley & Associates, 2015).

A spreadsheet containing plant data was available for download on the MLB website. This spreadsheet contained information about each plant including plant code, generation, emissions and percentage of ownership as of December 31, 2013. MJB pointed out in the Benchmarking report that “identifying ‘who owns what’ in the dynamic electricity generation industry is probably the single most difficult and complex part of this report” (M.J. Bradley & Associates, 2015). Identifying ownership is particularly challenging due to the fact that “shares of power plants are regularly traded and producers merge, reorganize, or cease operation altogether” (M.J. Bradley & Associates, 2015). Based on the amount of time and effort that MJB has put into identifying the correct ownership for each of the plants, this data was used as a template going forward. The assumption was made during this research that the MJB dataset had the correct ownership and was accepted as is, even with their disclaimer that there may be inadvertent ownership errors within the dataset (M.J. Bradley & Associates, 2015).

The GHG emissions in the Benchmarking report were calculated using information collected from EIA Form 923 including heat input data (M.J. Bradley & Associates, 2015). Also used in the emissions calculation is the carbon content coefficients per fuel type published by the EPA (M.J. Bradley & Associates, 2015). The resulting emissions in the Benchmarking report are in short tons (ST) of carbon dioxide. Most of the emissions disclosed by the electric generation companies are in metric tonnes (MT) of carbon dioxide equivalents (CO₂e), which contain carbon dioxide emissions, as well as methane and nitrous oxide emissions multiplied by their GWP (Please see Appendix 4 for more information on how emissions are calculated). Although the major

portion of CO₂e emissions comes from CO₂, CO₂ and CO₂e are not the same GHG measurement.

A number of regulatory programs in the United States collect data from the electric generation sector. One such program is the EPA's Greenhouse Gas Reporting Program (GHGRP) which requires facilities that emit more than 25,000 metric tonnes of GHG to submit an annual report to the EPA per 40 CFR Part 98 (EPA, 2016f). Emission data from the EPA's Facility Level Information on GreenHouse gases Tool (FLIGHT) (EPA, 2016f) was used in this research. The emissions within FLIGHT are in MT of CO₂e and need to be prorated by the ownership percentage.

In 2013 the EPA was in the process of aggregating the generation plants by parent company, but it was not complete at year's end. As a result, the generation plants listed in the Benchmarking report were used as the template for each company. Unfortunately the plant codes (ORIS) in the Benchmarking report do not match the plant IDs in FLIGHT, nor are all the plant names the same in each dataset. The EPA developed a spreadsheet titled *Power Plant Crosswalk* to assist in this process (EPA, 2016c). This spreadsheet did help in the linking process, however, not all the plants had been mapped yet, and there was significant manual matching involved. Based on the plants listed for each parent company in the Benchmarking report and using the Power Plant Crosswalk tables, it was possible to create a similar list of plants for each parent company with the GHGRP FLIGHT data.

The GHGRP FLIGHT data was, however, missing the GHG emissions of the smaller "peaking" plants because they usually do not emit more than 25,000 MT of CO₂e. This emission data was however in the Benchmarking dataset, but it is in ST of CO₂ not MT of CO₂e. Because the "reasonableness" test is just an estimation of the GHG for

each company, the decision was made to combine these two different datasets and used the Benchmarking CO₂ emissions to fill in the missing “peaking” plant emissions, once they were converted to MT of CO₂. The two datasets were combined since the “peaking” plants have relatively small emissions and CO₂ emissions from the Benchmarking report are the major component of CO₂e emissions. A total of 143 entries from the Benchmarking report were added to the GHGRP data, making a total of 795 different facilities with GHG emissions between the two data sets for the 29 companies included in the study. Estimated emissions due to the addition of the Benchmarking CO₂ data increased 1.1% (This type of combining of datasets should not be done when disclosing GHG emissions to the public or regulatory agencies). Combining the two datasets does not give a true representation of the company’s GHG emissions and it will underestimate the scope 1 emissions from stationary combustion.

A similar analysis was tried for EPA e-GRID data. This approach was unsuccessful because the data in e-GRID is from 2012. Difficulties were encountered because some of the ownership percentages were not the same for the different plants.

Three different emission datasets were developed for scope 1 emissions for the various electric generation utilities. First is the Benchmarking dataset taken from the Benchmarking report which includes the 100 largest electric power producers in the U.S. The emissions data is in short tons of CO₂ and was converted to metric tonnes of CO₂. The second dataset of scope 1 emissions is taken from the EPA’s GHGRP FLIGHT database for all entities that had NAICS code 2211 Electric Power Generation, Transmission and Distribution. The emissions data for the GHGRP is in metric tonnes of CO₂e. The third dataset is a combination of the EPA’s GHGRP FLIGHT dataset

combined with the Benchmarking dataset for the “peaking plants” or missing small power plants.

There are several different ownership types of power producers in the Benchmarking Top 100 including: public power (federal, state and municipal), cooperative power, privately held corporations and investor-owned corporations. Investor-owned parent companies were then chosen from the Benchmarking report. Investor owned companies were chosen from across the U.S. to give a variety of fuel used and power regulated markets. CDP participation was also a consideration. Listed in Table 7 are the parent corporate producers included in the study. The chosen parent companies accounted for 62% of the electrical generation for 2013, as well as 62% of the emissions from electrical generation in the U.S.

Table 7. Generation and emission data for parent companies included in research for 2013.

In order of 2013 generation			2013 Generation (MWh)			2013 Emissions	Responded to
						Short Ton	CDP in 2014
Rank	Owner	Ownership Type	Total	Fossil	Coal	CO2	
1	Duke	investor-owned corp.	243,353,097	168,200,141	102,338,834	136,952,436	Yes
2	Exelon	investor-owned corp.	195,054,967	30,721,290	9,363,453	19,530,597	Yes
3	Southern	investor-owned corp.	180,221,040	142,694,193	70,293,969	107,556,354	No
4	NextEra Energy	investor-owned corp.	175,676,789	99,052,840	5,187,397	48,781,601	No
5	AEP	investor-owned corp.	153,097,228	134,620,398	115,113,002	134,102,045	Yes
7	Entergy	investor-owned corp.	129,404,678	50,799,802	14,795,295	38,429,818	Yes
8	Calpine	investor-owned corp.	103,040,845	96,698,976	-	41,996,312	No
9	NRG	investor-owned corp.	99,374,142	88,716,313	62,330,456	83,761,255	Yes
10	FirstEnergy	investor-owned corp.	96,480,658	65,335,231	60,430,553	67,046,238	No
11	Dominion	investor-owned corp.	93,924,999	47,994,504	24,808,466	36,564,733	No
13	PPL	investor-owned corp.	88,630,487	67,132,456	57,000,317	66,768,135	No
16	Xcel	investor-owned corp.	68,834,675	55,681,360	41,275,618	53,414,813	Yes
17	Dynegy	investor-owned corp.	60,842,907	60,842,907	44,326,658	57,145,225	No
18	PSEG	investor-owned corp.	54,409,386	24,819,610	6,480,856	15,335,378	No
19	DTE Energy	investor-owned corp.	43,863,826	35,628,952	33,991,682	38,691,141	Yes
20	Ameren	investor-owned corp.	43,785,058	34,011,776	33,292,440	33,045,776	Yes
22	AES	investor-owned corp.	41,129,090	38,294,449	35,216,385	40,036,728	Yes
24	PG&E	investor-owned corp.	31,675,793	6,093,591	-	2,641,601	Yes
26	Great Plains Energy	investor-owned corp.	26,946,616	23,053,882	22,675,778	24,945,054	No
27	Pinnacle West	investor-owned corp.	26,680,373	17,317,620	11,292,238	14,958,001	Yes
29	Westar	investor-owned corp.	26,304,512	22,508,492	20,736,969	25,406,531	No
33	OGE	investor-owned corp.	23,961,116	22,330,656	12,759,335	20,048,061	Yes
35	Wisconsin Energy	investor-owned corp.	22,809,690	21,707,762	18,188,820	22,808,245	Yes
41	CMS Energy	investor-owned corp.	20,978,689	19,023,708	16,002,394	20,444,753	Yes
43	Alliant Energy	investor-owned corp.	18,640,181	16,764,548	14,483,297	17,809,186	Yes
51	NiSource	investor-owned corp.	14,153,141	14,143,205	11,563,943	14,659,277	Yes
53	IDACORP	investor-owned corp.	13,829,871	8,107,610	6,519,614	7,918,953	Yes
57	Sempra	investor-owned corp.	13,258,115	11,063,925	-	4,965,089	Yes
69	ALLETE	investor-owned corp.	11,079,012	9,873,294	9,856,675	11,704,892	No
		Total (in thousands)	2,121,440,982	1,433,233,495	860,324,445	1,207,468,226	
			62%			62%	

Scope 1 emission data were also collected from other publicly available sources including SEC 10-K reports, CDP report disclosures, and Sustainability/CSR reports. The Investors Relations page of the parent company usually had a link to the 2013 10-K reports. The EDGAR search feature on the SEC website was also used to find the needed 10-K reports (SEC, 2016). The 10-K reports were scanned for the disclosure of 2013 emissions for the parent company including subsidiaries. Sustainability and CSR reports were also scoured for information about GHG emissions for the company. When the necessary reports could not be located, an email was sent to the Investor Relations department for links to sustainability reports from 2013 (It is amazing how many of these

requests were never answered). I assumed that when the disclosure said XX tons of CO₂ or GHG emissions, but did not disclose the breakdown between scope 1 and 2, and whether it was short or metric tonnes of CO₂ or CO₂e, everything was assumed to be scope 1 short tons CO₂ emissions. Three of the CSR reports did not disclose CO₂ emissions, but did disclose carbon intensity ratios (lbs of CO₂/MWh). These intensity ratios were multiplied by the MWh reported in the Benchmarking report and then divided by 2200 to estimate the CO₂ emissions in metric tonnes.

A limited number of the CDP reports were obtained from the CDP website. To access individual public responses, the viewer needs to register with CDP (CDP, 2014b). By using the Advanced Search feature in CDP, the reports filed by electricity generator parent company were located. In the search box: Parent company name as it appears in the 10-K; for Program: Climate Change; for Year: CDP 2014; for Reporting status: All; and for Country: USA. CDP questionnaires are due for corporations by June 30th for the prior year's information. CDP will refer to the report by year that the questionnaire is filed not emission year. As a result, the 2014 CDP report will contain 2013 emission data. Included in the study group are 18 parent companies that publically disclosed their emissions to CDP in 2014. Eleven other companies were included in the study, but did not file their emissions with CDP in 2014. The type of information was gathered from the CDP report is displayed in Appendix 3 (CDP, 2014a).

Scope 2 Emissions

When a company purchases some of its electricity from the grid or independent power producer and transports the electricity through its T&D system, then the company needs to calculate scope 2 T&D losses (WRI & WBCSD, 2015). Anyone who consumes

electricity that's generated by someone else "(even if that consumption is 'involuntary' as with grid losses) then it's scope 2" (Sotos, 2016). Scope 2 includes GHG emissions from the "generation of purchased or acquired electricity, steam, heat or cooling consumed by the reporting company" (WRI & WBCSD, 2015).

Collecting purchased electricity data for the scope 2 "reasonable" testing was a little more challenging. Using the template developed from the plant data captured in the Benchmarking report, a list of subsidiaries for each parent company was developed. This information was then corroborated with information in the company's 10-K filing for 2013 and a viable list of subsidiary power companies was developed for each parent company. Data was then collected from the FERC eLibrary Docket search for the FERC Financial Report titled *FERC Form No.1 Annual Report* filed for each of these subsidiaries.

Information was gathered from FERC Form 1, pages 326 and 327, about the purchases of electricity the company had made during the year. These purchases were then analyzed and those electricity purchases that were made from affiliated companies were removed from the purchased electricity tally (the affiliated companies are reporting the scope 1 emissions for the initial generation of the electricity). Information from the Electric Energy Account page 401a was then collected as well, including line 9 for Net Generation, line 10 for Purchases, line 27 for Total Energy Losses and line 28 for Total MWh.

The purchased electricity was calculated using the information on line 10 for Purchases on page 401a and electricity purchased from the affiliated companies was backed out. To complete the analysis, the FERC Form No. 1 needed to be located for more than 100 subsidiaries of the parent companies. Each of the subsidiaries had

numerous purchase transactions that had to be analyzed to determine which were made from affiliated entities and needed to be backed out. This ended up being thousands of transactions. Although this data was available publicly, it was very time consuming to locate all the subsidiaries for the parent companies on the FERC website and go through the thousands of transactions. Some assistance in determining the utilities' affiliated and nonaffiliated purchases was received from the Edison Electric Institute using their database.

To calculate the T&D losses for each individual subsidiary, the total energy losses (line 27 on the Electric Energy Account sheet on page 401a), were divided by the total MWh in line 28 on the same page. These individual parent company T&D losses were for the most part lower than the eGRID2012 Grid Gross Loss % found in Table 3-5 of the Technical Support Document for eGRID with Year 2012 Data (EPA, 2015b). This means that the T&D losses calculating the company specific T&D loss % factor will be smaller than if the T&D loss factor from eGRID2012 had been used. The resulting emissions were a more conservative estimate of T&D losses emissions that should have been included in scope 2. If a company's loss factor did not seem reasonable, then the eGRID loss factor was used.

To calculate the estimated emissions for the T&D losses from the purchased electricity, the nonaffiliated purchased electricity amount calculated for each subsidiary was then multiplied by each of the subsidiary's own calculated T&D loss factor to calculate the MWh of electricity from Non-affiliated T&D losses. The eGRID subregion was then determined for each of the subsidiaries. The emission factors for each of these eGRID subregions were then obtained from the eGRID2012 GHG Annual Output Emission Rates found on the EPA website (EPA, 2015a). Using these eGRID emission

factors, the GHG emissions from CO₂, CH₄ and N₂O were calculated. These emissions were then multiplied by the SARS GWPs found on page 10 of the eGRID Technical Support Document to get metric tonnes of CO₂e (EPA, 2015b).

The final step in the process was to add up the CO₂e emissions from the purchased electricity T&D loss for each of the individual subsidiaries that belonged to the parent company. The resulting calculation determined the “reasonable estimate” of the minimum scope 2 CO₂e emissions that the parent company should have disclosed. This “reasonable estimate” does not include any of the other scope 2 CO₂e emissions that the parent company may have had during the year.

The formula used to calculate the T&D losses for scope 2 emissions was the same formula used in 2013-2014. There is, however, a new scope 2 requirement that has taken place since the calculation of these 2013 emissions. Per Mary Sotos at WRI, the “new scope 2 guidance (see GHGP website) requires companies to estimate emissions using two different methodologies – location-based and market-based. Location-based would indeed use eGRID emission factors by sub-region, and market-based would use utility-specific emission factors, other contractual purchases, RECs, or the residual mix. (See GHGP scope 2 for more guidance on these data types)” (Sotos, 2016).

Scope 3 Emissions

Purchasing nonaffiliated electricity to meet the entity’s electricity needs, and the sale of this electricity to its customers, results in scope 3 emissions. To “reasonably estimate” these scope 3 emissions, much of the same data collected for the scope 2 T&D losses emissions were used for the analysis. The nonaffiliated purchases information gathered from FERC Form 1, pages 326 and 327, was used for the calculation of scope 3

emissions for the 100 plus subsidiaries. This should be the same purchase number used in the calculation of scope 2 emissions before the T&D loss percentage was applied. The same eGRID sub regions used in the calculation of scope 2 emissions were used, as well as the same emission factors and GWPs that were used in the earlier calculation. The resulting GHG emissions were the minimum scope 3 emissions that the parent company should be reporting and this amount was used in the “reasonable test” for scope 3 emissions.

Chapter III

Results

Several different tests were performed to analyze the voluntary disclosure of scope 1, 2 and 3 emissions in the utilities' annual 10-K statements, sustainability/CSR reports, and CDP questionnaire. These tests were designed to test the “reasonableness” of the emissions disclosed, given information that was filed in regulatory databases. Minimum emissions quantities were determined for stationary combustion for scope 1, T&D losses for scope 2 and fuel-and-energy-related activities for scope 3. These emissions combine to create the company's carbon footprint and a measure of their “climate friendliness”. By performing this analysis of the disclosed emissions, it will be apparent whether or not the electric utilities within this study consistently disclosed to their investors and public the true climate risks their companies face.

Specific aims #1-3 were designed to test the “reasonableness” of the emissions disclosed for scope 1 from stationary combustion in the generation of electricity. Specific aim #4 was designed to test if the utility was disclosing the minimum scope 2 emissions due to their T&D losses. Specific aim #5 tested whether the company disclosed the minimum scope 3 emissions due to the purchase of electricity to meet the needs of their customers.

Specific Aim #1 - CSR vs. GHGRP

Specific aims #1-3 were testing the different regulatory data emissions against the various published reports where the utilities disclosed their 2013 scope 1 emissions.

These published reports include the annual SEC 10-K statement, their sustainability/CSR report and their response to the CDP questionnaire.

Specific Aim #1 was to determine if an entity's scope 1 disclosed emissions were "reasonable"? Are the emissions disclosed in the company's CSR report greater than or equal to the stationary combustion emissions reported by the GHGRP?

Tables 8 through 10 show that companies both underreported and over reported their scope 1 emissions compared to the projected emissions. Note: Company # in Tables 8 through 10 are based on alphabetical order versus the ranking order in Table 7 (page 47).

Table 8. Scope 1 emissions of CO₂e (MT) - CSR vs. GHGRP.

Company #	CSR	GHGRP	Difference between CSR and GHGRP	% Different
1	115,300,000	120,010,883	(4,710,883)	-3.9%
2	75,169,843	36,346,541	38,823,302	106.8%
3		10,708,796		
4	18,500,000	17,250,849	1,249,151	7.2%
5	58,629,348	30,263,208	28,366,140	93.7%
6		40,722,878		
7	17,927,243	19,787,707	(1,860,464)	-9.4%
8	33,860,000	33,849,135	10,865	0.0%
9	39,000,000	34,877,758	4,122,242	11.8%
10	121,215,528	122,156,715	(941,187)	-0.8%
11		50,855,588		
12	34,214,242	34,123,648	90,594	0.3%
13	18,697,000	17,861,175	835,825	4.7%
14	60,000,000	58,867,100	1,132,900	1.9%
15		22,627,490		
16	7,229,251	7,094,838	134,413	1.9%
17	45,479,837	43,610,279	1,869,559	4.3%
18	14,426,984	14,427,302	(318)	0.0%
19	75,000,000	75,715,624	(715,624)	-0.9%
20		17,797,884		
21	3,770,000	2,382,746	1,387,254	58.2%
22	14,227,295	14,267,093	(39,798)	-0.3%
23	62,927,646	60,239,250	2,688,396	4.5%
24	14,955,608	14,010,519	945,089	6.7%
25	7,500,000	4,508,878	2,991,122	66.3%
26	102,000,000	102,128,659	(128,659)	-0.1%
27		23,310,959		
28	23,000,000	21,781,942	1,218,058	5.6%
29	53,075,667	49,365,564	3,710,103	7.5%

- No scope 1 emissions reported in CSR
- Emissions underreported compared to GHGRP data

The scope 1 emissions disclosed in 22 of the companies' CSR reports were "reasonable", and were not significantly greater than the emissions reported to GHGRP

(t-test, $p=0.07$, $n=23$) (Table 8). CSR and GHGRP are tightly correlated ($\text{adj.}r^2=0.92$) with some extreme outliers as reporting discrepancies ($p<.001$, $n=23$, $\text{GHGRP} = 5346262 + 0.947 \cdot \text{CSR}$) (Figure 9).

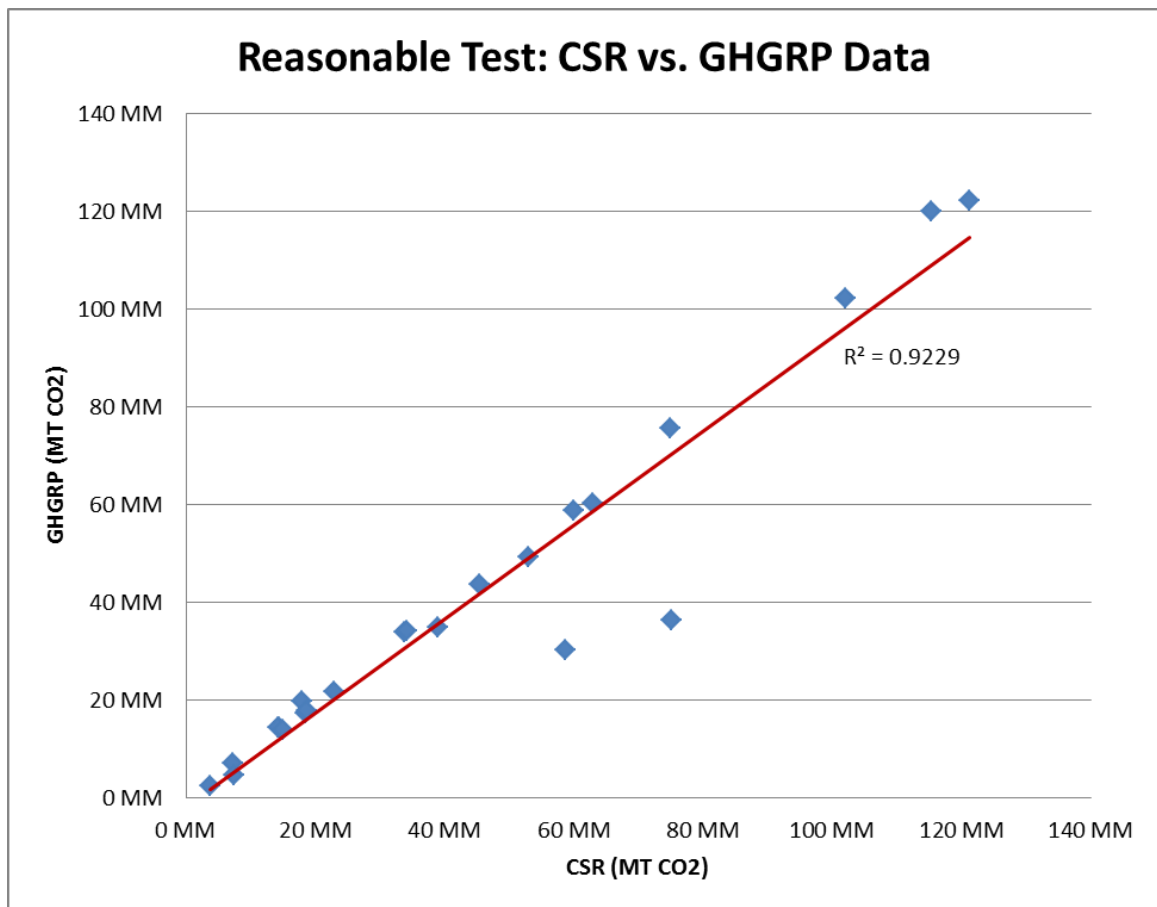


Figure 9. Reasonable test - CSR vs. GHGRP.

Specific Aim #2 - CSR vs. Benchmarking


This analysis was performed to determine if an entity's stationary combustion emissions reported in the M.J. Bradley & Associate (2015) Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States (Benchmarking) report were a "reality check" for the emissions reported by the company in their CSR report for

scope 1? Were the disclosed emissions greater than or equal the Benchmarking Air Emissions report?

Scope 1 emissions reported in 22 of the companies' CSR reports were "reasonable" (Table 9), but were marginally higher than the Benchmarking report when the two outliers were included in the analysis (t-test, $p=0.04$, $n=23$). However, when these two outliers were taken out of the analysis, the two datasets were not significantly different (t-test, $p=0.07$, $n=21$). Scope 1 emissions disclosed in the CSR reports were highly correlated with the emissions reported in the Benchmarking report ($p<.001$, adj. $r^2=0.99$, $n=21$, Benchmarking = $2147224 + 0.968 \cdot \text{CSR}$ (Figure 10).

Table 9. Scope 1 emissions of CO₂e (MT) - CSR vs. Benchmarking.

Company #	CSR	Benchmarking	Difference between CSR and Benchmarking	% Different
1	115,300,000	121,657,375	(6,357,375)	-5.2%
2	75,169,843	36,321,320	38,848,523	107.0%
3		10,618,678		
4	18,500,000	16,156,329	2,343,671	14.5%
5	58,629,348	29,978,019	28,651,329	95.6%
6		38,396,715		
7	17,927,243	18,547,480	(620,237)	-3.3%
8	33,860,000	33,171,526	688,474	2.1%
9	39,000,000	35,099,134	3,900,866	11.1%
10	121,215,528	124,241,381	(3,025,853)	-2.4%
11		51,842,148		
12	34,214,242	34,863,531	(649,289)	-1.9%
13	18,697,000	17,709,546	987,454	5.6%
14	60,000,000	60,824,347	(824,347)	-1.4%
15		22,628,708		
16	7,229,251	7,184,075	45,176	0.6%
17	45,479,837	44,254,668	1,225,169	2.8%
18	14,426,984	13,298,896	1,128,088	8.5%
19	75,000,000	75,988,003	(988,003)	-1.3%
20		18,187,601		
21	3,770,000	2,396,460	1,373,540	57.3%
22	14,227,295	13,569,898	657,397	4.8%
23	62,927,646	60,572,052	2,355,594	3.9%
24	14,955,608	13,912,255	1,043,353	7.5%
25	7,500,000	4,504,329	2,995,671	66.5%
26	102,000,000	97,459,963	4,540,037	4.7%
27		23,048,805		
28	23,000,000	20,691,640	2,308,360	11.2%
29	53,075,667	48,457,868	4,617,799	9.5%

 No scope 1 emissions reported in CSR


 Emissions underreported compared to Benchmarking data

Figure10 is a graphic representation of the data from both datasets.

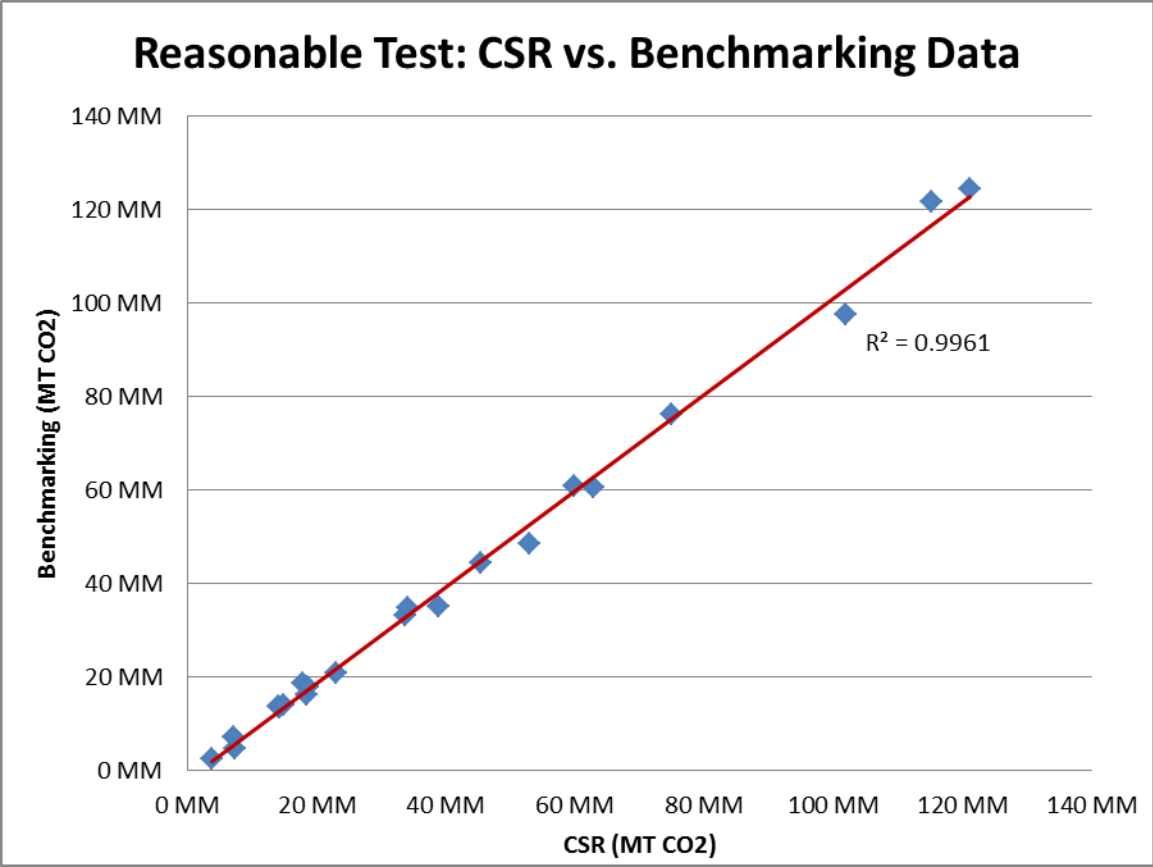


Figure 10. Reasonable test - CSR vs. Benchmarking.

Specific Aim #3 - CSR / 10-K / CDP vs. Best Data

This analysis was performed to determine if an entity’s disclosed scope 1 emissions from Best Data (GHGRP dataset combined with the peaking emissions from the Benchmarking dataset) are less than the comparison groups.

Table 10. Scope 1 comparison of data sources - CO₂e (MT).

Company #	Best Data	CSR	10-K	CDP
1	121,127,835	115,300,000	114,000,000	120,807,200
2	36,347,449	75,169,843	40,600,000	36,492,650
3	10,920,817			
4	17,280,099	18,500,000	26,600,000	26,551,183
5	30,264,311	58,629,348		32,978,295
6	42,024,217		40,824,000	
7	21,414,537	17,927,243	15,422,400	17,308,533
8	33,918,174	33,860,000	33,900,000	
9	35,062,550	39,000,000		36,500,000
10	125,088,661	121,215,528	121,564,800	122,316,000
11	50,858,531			
12	34,929,773	34,214,242	41,912,640	34,214,242
13	17,950,898	18,697,000		18,564,422
14	58,867,100	60,000,000		
15	22,633,937		22,680,000	
16	7,094,885	7,229,251		7,204,042
17	43,651,551	45,479,837		
18	14,427,302	14,426,984		19,146,240
19	76,051,689	75,000,000	76,000,000	74,727,000
20	17,797,884			20,630,659
21	2,391,570	3,770,000	2,922,022	4,105,291
22	14,267,337	14,227,295		14,227,295
23	60,250,897	62,927,646	56,246,400	
24	14,010,606	14,955,608		
25	4,508,878	7,500,000		6,062,859
26	102,538,179	102,000,000	103,000,000	
27	23,310,959			
28	21,927,767	23,000,000		21,924,000
29	49,417,158	53,075,667	51,801,120	52,178,081

For complete comparisons, see the following subsections:

- a. CSR vs. Best Data.
- b. SEC 10-K vs. Best Data.
- c. CDP vs. Best Data.

#3a – CSR vs. Best Data

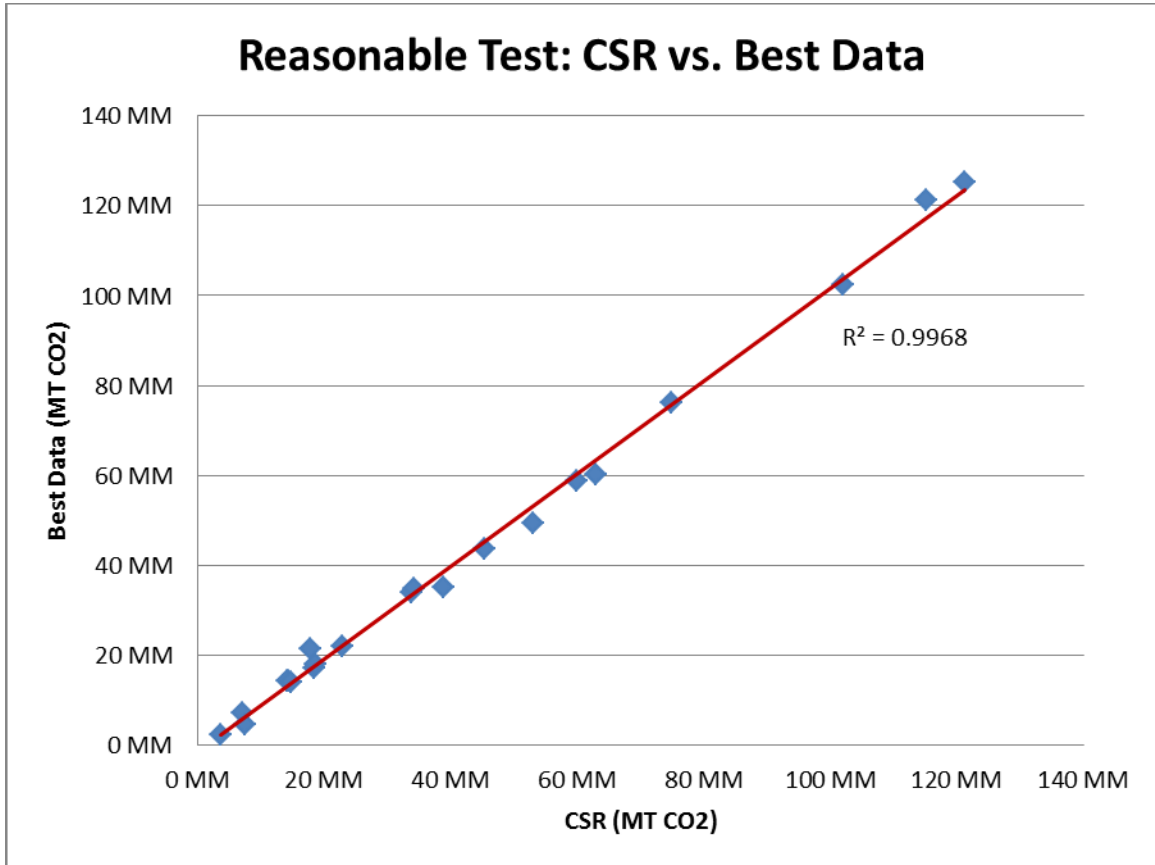


Figure 11. Reasonable test - CSR vs. Best Data.

The scope 1 emissions disclosed in 22 of the companies' CSR reports were "reasonable" (Table 10), but were marginally higher than those calculated using Best Data, when the two outliers were included in the calculation (t-test, $p=0.05$, $n=23$). When the outliers were removed from the data, the results were better (t-test, $p=0.29$, $n=21$). Scope 1 emissions disclosed in the CSR reports were highly correlated with the emissions reported in the calculated Best Data ($p<.001$, adj. $r^2=0.99$, $n=21$, Best Data = $1768513 + 0.965 \times \text{CSR}$ (Figure 11).

#3b- 10-K vs. Best Data

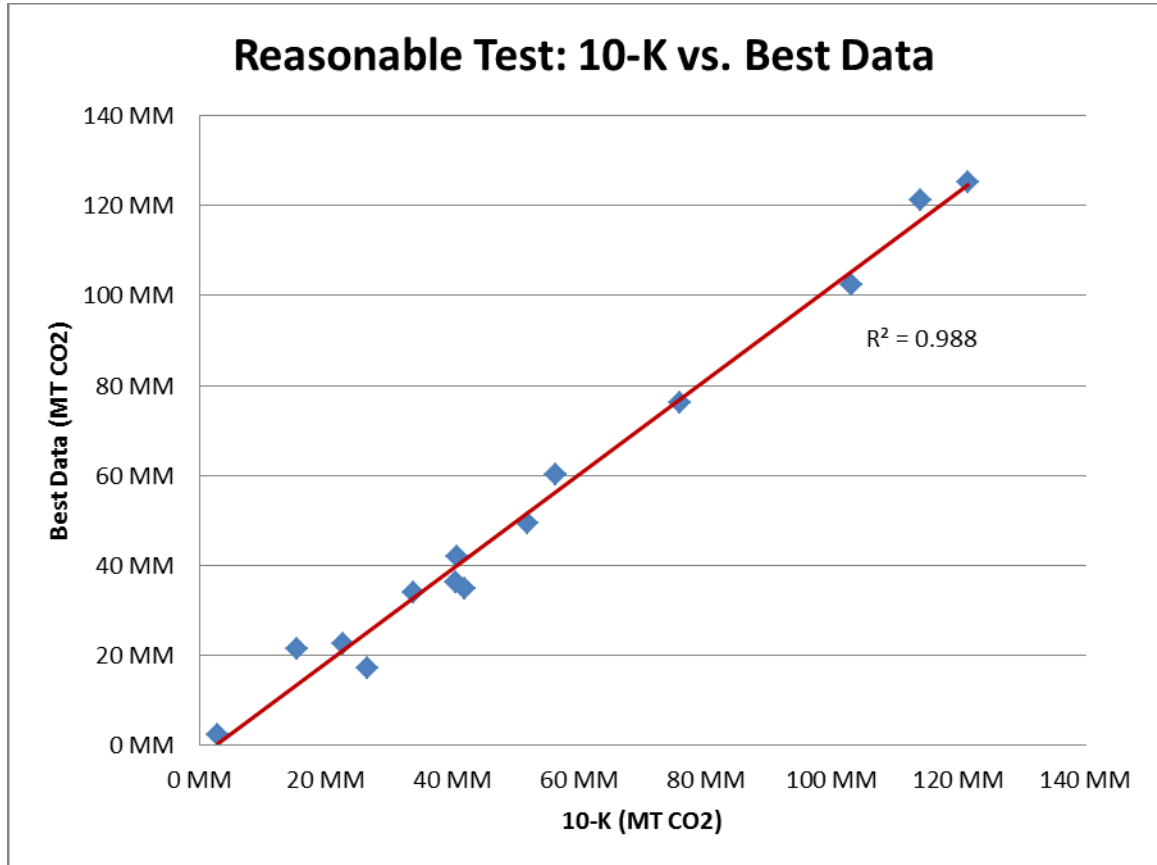


Figure 12. Reasonable test - 10-K vs. Best Data.

Scope 1 emissions disclosed in the company 10-K reports filed with the SEC, were not significantly higher than the calculated Best Data emissions (t-test, $p=0.45$, $n=14$). The emissions disclosed in eleven of the 10-K reports were “reasonable” (Table 10). The means of each data set were very close, as the two outliers seen in the previous specific aims are not present in this analysis. The scope 1 emissions reported in the 10-K reports were highly correlated with Best emissions ($p<.001$, adj. $r^2=0.99$, $n=14$, Best Data = $3145788 + 0.944 \times 10\text{-K}$) (Figure 12).

#3c- CDP vs. Best Data

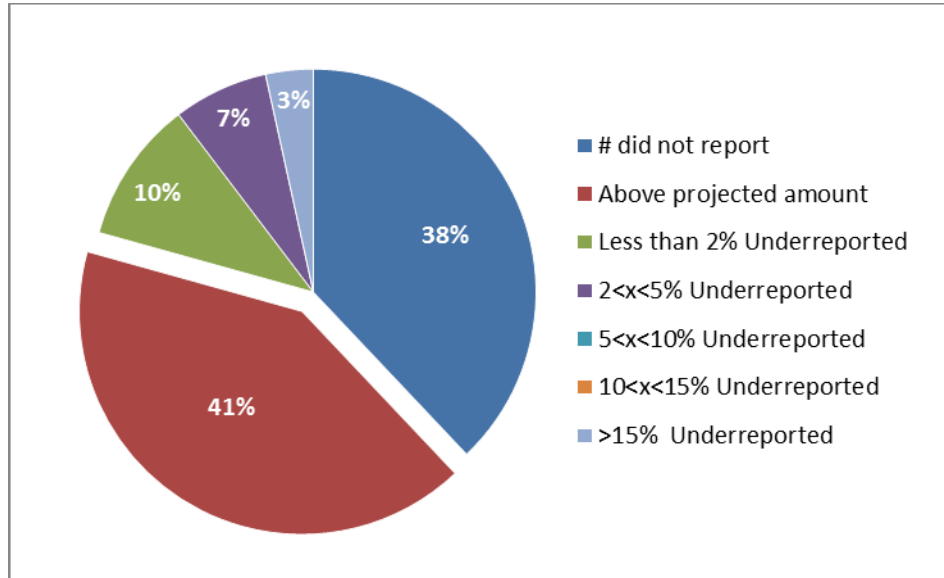


Figure 13. CDP disclosure of scope 1 vs. Best Data.

CDP disclosed scope 1 emissions filed were not significantly higher than the calculated Best Data emissions (t-test, $p=0.08$, $n=18$). The emissions disclosed in the CDP reports were “reasonable” for 17 companies (58%), with the majority of the emissions reported greater than the Best Data emissions (Figure 13). The scope 1 emissions reported in the CDP reports were highly correlated with Best emissions ($p<.001$, adj. $r^2=0.99$, $n=18$, Best Data = $2148861 + 0.969 \times \text{CDP}$) (Figure 14).

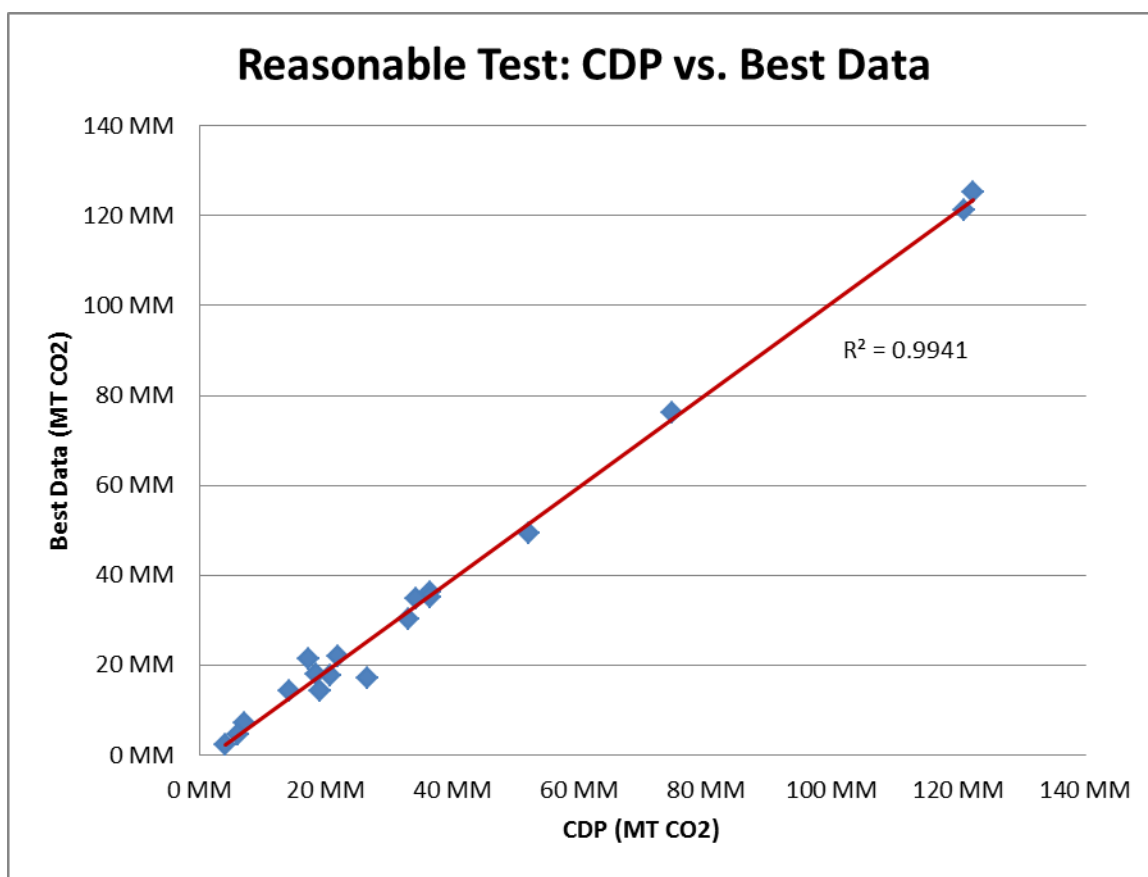


Figure 14. Reasonable test - CDP vs. Best Data.

Specific Aim #4 - Scope 2 T&D Losses

This analysis was performed to determine if an entity's disclosed scope 2 emissions were reasonable? Also, based on the utility's purchased electricity amounts, are they including T&D losses when disclosing scope 2?

One company disclosed their scope 2 emissions from T&D losses in their sustainability/CSR report. Of the 18 companies that filled out the CDP questionnaire, 16 of them included scope 2 emissions. Of these 16, six disclosed emissions from T&D losses. (If the CDP report did not specifically disclose that their scope 2 emissions were from T&D losses, then they were assumed to be Scope 2 emissions from electricity used in their buildings.) As seen in Table 11, seven companies disclosed their scope 2

emissions from T&D losses.

Table 11. Scope 2 emissions from T&D Losses.

Company	CDP/CSR	Projected	Difference	% Difference
1	88,200	733,148	(644,948)	-87.97%
2	891,922	584,516	307,406	52.59%
3	5,776,749	1,959,246	3,817,503	194.85%
4	25,724	118,724	(93,000)	-78.33%
5	1,199,102	1,106,718	92,384	8.35%
6	226,802	331,410	(104,608)	-31.56%
7	863,129	1,104,339	(241,210)	-21.84%

 Emissions underreported compared to Projected data

Scope 2 emissions were not “reasonable” (Table 11). Only seven companies reported their scope 2 emissions, and only three (11%) of the utilities met the projected minimum scope 2 emissions (Table 11 and Figure 15). (Data from FERC was unavailable for 3 companies.) The reported scope 2 emissions were not significantly different than the projected scope 2 for the seven companies that did disclose their scope 2 emissions from T&D losses (t-test, $p=0.23$, $n=7$). The correlation between the two scope 2 datasets wasn’t as strong as scope 1 emissions ($p<.001$, adj. $r^2=0.73$, $n=7$, $\text{CDP/CSR} = 503080 + .266 * \text{projected T\&D losses}$) (Figure 16).

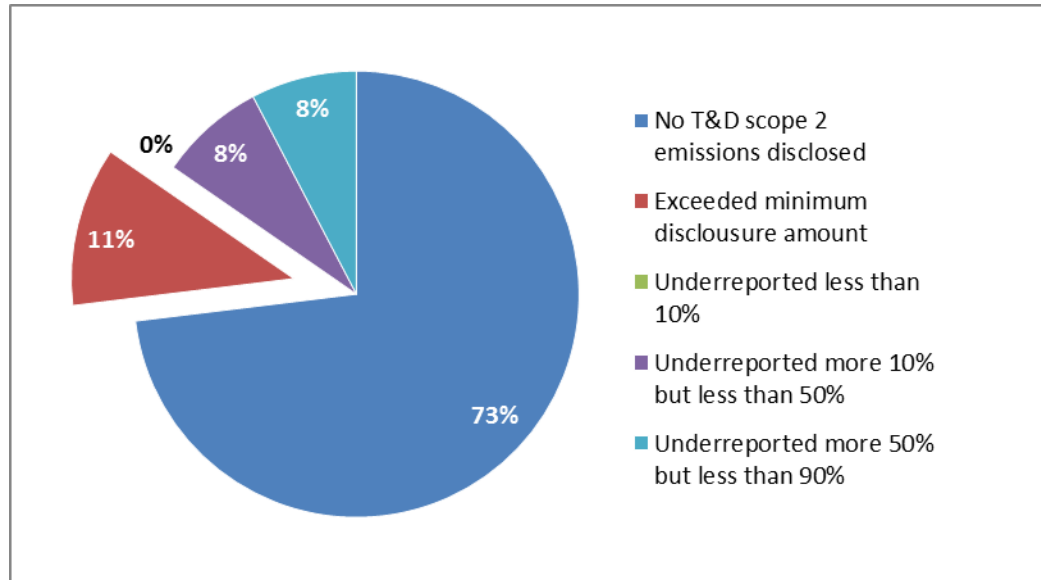


Figure 15. Disclosure of scope 2 T&D losses.

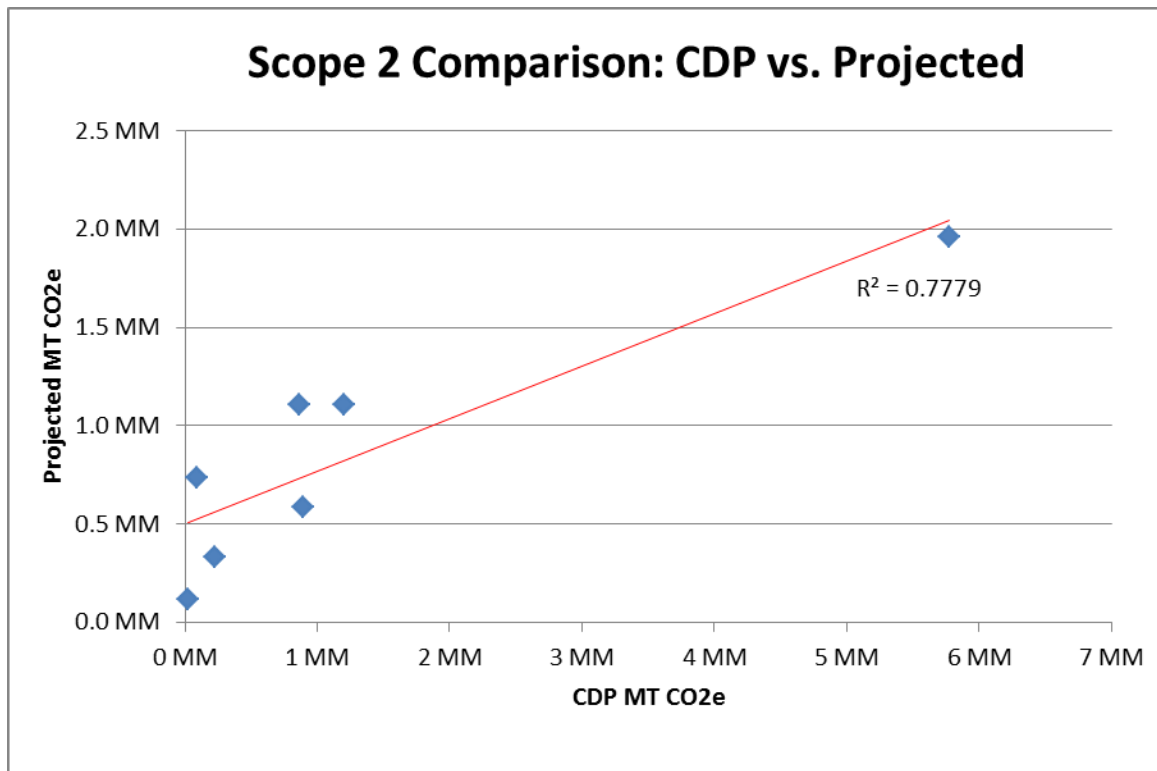


Figure 16. Comparison of scope 2 T&D losses emissions between CDP amounts and projected emissions.

Specific Aim #5 - Scope 3 Emissions from Purchased Electricity

Analysis of the data was performed to determine if an entity's disclosed scope 3 emissions were reasonable? Also, based on the utility's purchased electricity amounts, are these emissions included in scope 3?

As in Specific Aim #4, the nonaffiliated electricity purchases listed in the FERC Form 1 report are used in the calculation of scope 3 emissions. All 26 utilities did have nonaffiliated electricity purchases that were used in determining their "reasonable" minimum scope 3 emissions from #3 fuel-and-energy-related activities.

Table 12. Scope 3 emissions from purchased electricity.

Company	CDP/CSR	Projected	Difference	% Difference
1	3,093,226	5,580,717	(2,487,491)	-44.6%
2	16,943,341	15,480,914	1,462,427	9.4%
3	75,755,452	18,096,239	57,659,213	318.6%
4	2,567,493	2,600,578	(33,085)	-1.3%
5	14,041,680	15,416,425	(1,374,745)	-8.9%
6	2,771,528	8,195,973	(5,424,445)	-66.2%
7	14,009,967	26,137,748	(12,127,781)	-46.4%

 Emissions underreported compared to projected data

Seven of the 26 companies disclosed scope 3 fuel-and-energy-related activities emissions, with only 8% of the utilities meeting the minimum scope 3 projected emissions (Table 12) and Figure 17). (Data from FERC was unavailable for 3 companies). Scope 3 emissions reported were not "reasonable" (Table 12). The reported scope 3 emissions were not significantly different than the projected scope 3 (t-test, $p=0.28$, $n=7$). There wasn't as much correlation between the two scope 3 datasets ($p<.001$, adj. $r^2 = 0.05$, $n=7$, Projected scope 3 = $-447319 + 1.446 * \text{CDP/CSR}$.) (Figure 18).

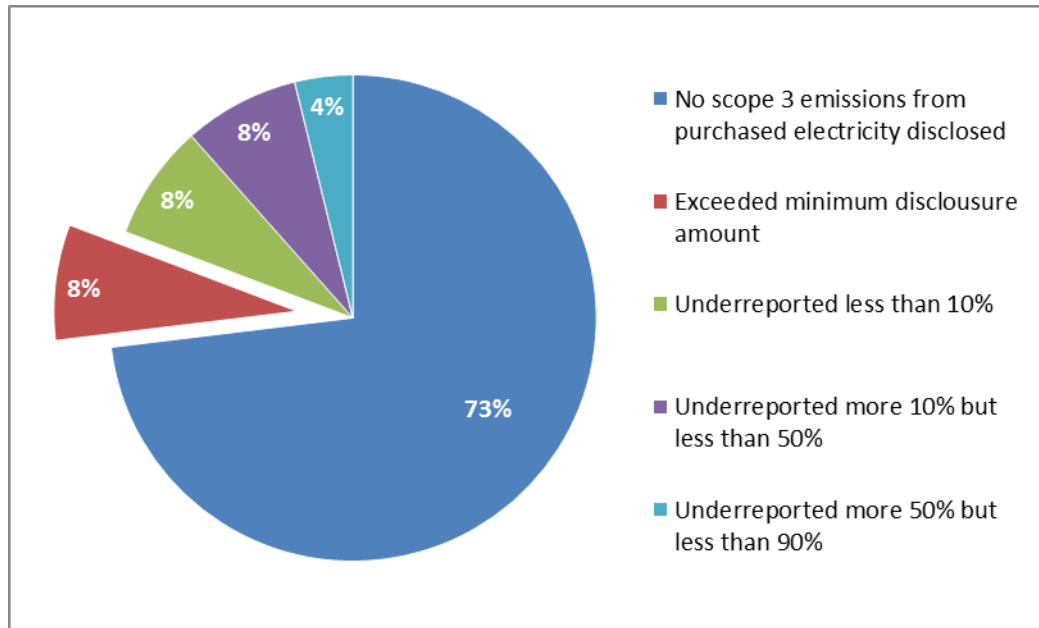


Figure 17. Disclosure of scope 3 emissions from purchased electricity.

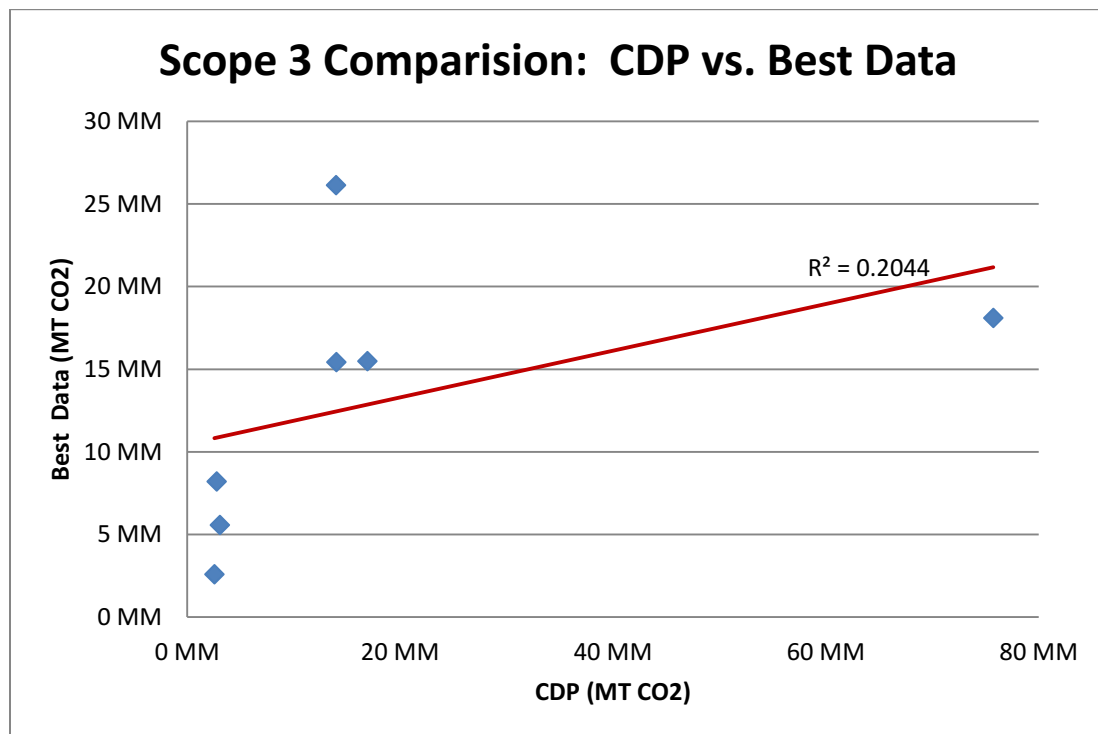


Figure 18. Comparison of scope 3 emissions CDP vs. Best Data emissions.

Information was collected from the CDP questionnaires including the protocol/standard used (Question # CC7.2); source of GWP used (CC7.3); source of emission factors (CC7.4); organizational boundary chosen for scope 1 and 2 (CC8.1); and the type of assurance by scope. Results can be seen in Tables 13 – 15.

Table 13. Protocols and organizational boundaries used in CDP questionnaire.

CC7.2 Protocol/Standard used to collect activity data	# of companies	CC8.1 Organizational boundary for Scope 1 and 2	# of companies
US EPA Mandatory GHGRP	6	Equity	10
US EPA Acid Rain	1	Operational*	6
Multiple standards and protocols	10	Financial*	2
Other	1	Other	1
		*One company used both Operational and Financial	

Table 14. Source of emission factors and GWPs used in CDP questionnaire.

CC7.4 Source of emission factors used in the calculations	# of companies	CC7.3 Source of GWP used for CH4	# of companies
TCR	2	SAR	7
EPA 40 CFR 98	3	TAR	0
Multiple sources used	5	AR4	6
Climate Leaders 2004	1	Other	4
2006 IPCC	1	None disclosed	1
Other	1		
None mentioned	3		
Couldn't access spreadsheet on CDP	2		

Table 15. Type of assurance used in CDP questionnaire.

Type of Assurance for Disclosed Emissions by Scope						
	Reasonable	Limited	Other	None	Total	% Not Assured
Scope 1	3	3		12	18	67%
Scope 2	4	1		10	15	67%
Scope 3	3	1	1	2	7	29%

Chapter IV

Discussion

The primary research question was to evaluate whether the GHG emissions being voluntarily disclosed by these electric utilities are “reasonable” and present a true picture of their climate friendliness. Anticipating a future low carbon economy, SRI investors are making financial decisions now about their portfolios based on the ESG data, including GHG emissions that are being disclosed by companies. The SRI investors obtain data from a number of different sources, including the company’s 10-K filing with the SEC, sustainability and/or CSR reports, as well as CDP data if that is available for the company. The SRI investor may also obtain data from a third party provider as well.

This study focused on a subset of sources SRI investors typically use to conduct financial analyses. Using the carbon data available from these sources, the “reasonableness” of the GHG emissions for 29 large and mid-size electric utilities was tested. Specific aims 1-3 were designed to determine whether the utilities were disclosing a minimum quantity of scope 1 emissions from stationary combustion. These aims compared carbon data from various publicly available sources with the emissions disclosed by the utility in their CSR/sustainability reports, annual SEC 10-K reports, and in CDP filings. Specific aim #4 tested whether the utility was disclosing above the minimum scope 2 emissions attributed to T&D losses associated with the nonaffiliated electricity purchased by the utility. Specific aim #5 was devised to determine if the minimum quantity of scope 3 emission from the purchased electricity was disclosed by

the reporting company. The utility's nonaffiliated electricity purchases used in specific aim #4 and 5 were taken from the FERC database.

Scope 1 emissions voluntarily disclosed by the utility were compared against GHG emissions from stationary combustion data filed by the company in governmental databases (Electric generation utilities are required to file yearly reports with both the EPA GHGRP and FERC). Using data from both the Benchmarking and GHGRP datasets, a "reasonable" minimum scope 1 amount was calculated for each company. Tests were then performed to determine if the scope 1 emissions disclosed by the parent company in various reports were greater than or equal to their stationary combustion emissions reported to the regulatory agencies. Most of the companies, 23 out of 29 (79%) of the companies published a CSR/sustainability report disclosing their GHG emissions or carbon intensity ratios that was used to determine their emissions. Eighteen out of 29 companies (62%) filled out the 2014 CDP Questionnaire. Company emissions were disclosed in 14 of the 29 (48%) of the companies' 2013 annual 10-K reports.

In general, most companies did a "reasonably" good job disclosing scope 1 stationary combustion emissions based on the fact that their scope 1 emissions disclosed ranged from 5% underreporting to greater than or equal to the regulatory data. There is a 5% materiality threshold used by TCR, so this same threshold is used in this study for the acceptable range of under reporting. Acceptable disclosed emissions are shown in Table 16, highlighted in green. More than 90% of the companies that filled out the CDP Questionnaire or published a CSR report were within an acceptable range of the projected minimum scope 1 emissions.

For the companies that included scope 1 emissions in their annual 10-K reports, 11 out of 14 (79%) of them disclosed emissions that were within an acceptable range of

the projected scope 1 emissions. Stationary combustion emissions make up the vast majority of scope 1 emissions for the electric power generation sector. Less than 30% of the companies broke down their scope 1 emissions into all the different categories of emissions used by the GHG Protocol including mobile (8 companies), process (5 companies) or fugitive (7 companies) emissions. The GHG accounting and reporting principle of completeness was violated by many of the companies. This principle requires that the entity “account for and report on all GHG emission sources and activities within the chosen inventory boundary” (WRI & WBCSD, 2000). The reporter is also supposed to disclose and justify any specific exclusions (WRI & WBCSD, 2000). Based on this principle, the company shouldn’t pick and choose which emissions they want to disclose to the public.

Listed in Table 16 are the results of the testing for the Specific aims 1 – 5.

Table 16. Underreporting of emissions for scopes 1, 2 and 3.

Specific Aim	Situation	# did not report	Greater than projected amount	Less than 2% Under-reported	2<x<5 % Under-reported	5<x<10 % Under-reported	>15% Under-reported	Amounts >15% Under-reported
1	CSR vs GHGRP	6	17	4	1	1		
2	CSR vs Bench	6	17	3	2	1		
3a	CSR vs Best Data	6	15	5	2		1	16%
3b	10-K vs Best Data	15	7	2	2	2	1	28%
3c	CDP vs Best Data	11	12	3	2		1	19%
Scope 2 Emissions								
4	CDP vs Projected	22	3				4	20%, 32%, 78%, 88%
Scope 3 Emissions								
5	CDP vs Projected	22	2	1		1	3	45%, 46%, 66%

The companies that had values within the highlighted green section disclose their emissions within an acceptable range.

Specific Aim #1 - CSR vs. GHGRP

Specific aim #1 addressed the emissions disclosed in the company's CSR report and whether they were greater than or equal to the stationary combustion emissions reported to the EPA's GHGRP. Of the companies examined, GHG emissions were only disclosed in 23 out of 29 annual CSR/Sustainability reports for slightly more than three

quarters companies (79%). In looking at the differences between the emissions disclosed by the company and the emissions calculated in GHGRP from stationary emissions, 17 out of 23 companies (74%) disclosed more than “reasonableness” minimum for scope 1. This would indicate that they were disclosing more than the minimum emission from stationary combustion than they reported to GHGRP. Five more of these companies disclosed “reasonable” emission amounts, which indicate that they underreported their emissions within 5% of the minimum projected emissions. The final company was almost 9% below the “reasonable” estimated amount of scope 1 emissions. The value for this company’s CSR emissions however was back calculated from an intensity ratio listed in their CSR report which may explain why the emissions varied so much from the estimated amount.

A plot of the emissions from the CSR report vs. the “reasonable” GHGRP data had an $r^2=0.92$. There were two companies that disclosed significantly more scope 1 emissions in their CSR report than was calculated from their stationary combustion. One of these companies had disclosed their global emissions and the EPA’s GHGRP only calculates emissions for U.S. electric generating facilities. The other company had scope 1 emissions listed in their CSR that were almost twice what was calculated as the “reasonable” minimum stationary combustion emissions for scope 1 emissions. Their emissions disclosed in their CSR report was more than scope 1, 2 and 3 emissions disclosed in their CDP report. The diagram of the company’s emissions shown in this CSR report was updated in 2015 and the emissions are more in line with those disclosed in CDP. When these two companies were removed from the sample, the $r^2 = 0.99$, which showed a better correlation between the two sets of data. Results of the paired two

sample mean t-test including the two mentioned companies, was $t=2.07$, $n=23$, $p>0.05$, indicating that the two datasets are not significantly different.

Specific Aim #2 - CSR vs. Benchmarking

Specific aim #2 dealt with whether the Benchmarking report was a “reality check” for the emissions reported by the company in their CSR report for scope 1. There were 6 companies (21%) that did not report GHG emissions in their annual CSR/Sustainability reports. Of the 23 companies that did disclose their emissions, 17 disclosed greater than the “reasonable” minimum scope 1 emissions and 5 companies were within 5% of the estimated amount of the companies’ minimum emissions that should be disclosed. The final company was only 5.2% lower than the projected emissions results. This company is different than the one that underreported their emissions in specific aim #1. Similar to the results for specific aim #1, the graph for specific aim #2 has an $r^2=0.92$. Both graphs include the same two companies which show very high emissions compared to the estimated amounts. When the two outliers were removed from the sample, the adjusted $r^2=0.99$. The results of the paired t-test $t=2.07$, $n=21$, $p>0.05$, indicating that the two datasets are not significantly different.

Specific Aim #3 - CSR / 10-K /CDP vs. Best Data

Specific aim #3 analyzes the emission from Best Data (GHGRP dataset combined with the peaking emissions from the Benchmarking dataset) determining if it is equal to the comparison groups. These comparison groups are:

- a. CSR vs. Best Data.
- b. SEC 10-K vs. Best Data.

c. CDP vs. Best Data.

Results for this specific aim (#3a) had fewer utilities that were greater than the projected minimum scope 1 emissions than specific aim 1&2. This is due to the fact that Best Data emissions are higher for most utilities than they are in the Benchmarking and GHGRP datasets. As mentioned earlier, there were six companies that did not report GHG emissions in their annual reports CSR/Sustainability. Under specific aim #3a, only 15 companies disclosed the requisite minimum GHG emissions in their CSR report when compared to the higher Best Data emissions. Seven companies disclosed within 5% of the “reasonable” estimate of Best Data. The final company underreported their emissions by more than 16%. This sample also includes the two companies that had emissions significantly higher than the projected amount. The paired sample t-test was run without the two outliers and $t=2.09$, $n=21$, $p>0.05$, so there is no significant difference between the two sample sets. The $r^2=0.99$ indicating good correlation and fit of the data.

In specific aim #3b, only 14 of the 29 (45%) companies in the study disclosed any GHG emissions about their company in their annual SEC 10-K. The remaining 15 contained boiler plate information about climate change and emissions, but nothing specific about their company’s emissions. Of the 14 that disclosed GHG emissions, seven companies disclosed more than the minimum projected scope 1 emissions, and four companies disclosed 5% less than the “reasonable” minimum for scope 1. Three companies (23%) under disclosed their emissions by more than 5%. Two companies under disclosed between 5 and 10% and the final company however, appears to underreporting scope 1 by 28%. A paired t-test was run $t=2.16$, $n=14$, $p>0.05$, indicating that there is no significant difference between the two datasets. The $r^2=0.99$ indicating good correlation and fit of the data. One of the companies that had disclosed

significantly higher emissions in their CSR report, did not disclose any emissions in their 10-K. The second company with the significantly higher scope 1 emissions listed in their CSR report due to the inclusion of global emissions, had a breakdown of their global emissions in their 10-K, with their U.S. emissions stipulated, so the U.S. amount was used in this analysis.

In specific aim #3c, 18 of the companies in the study disclosed to CDP in 2014. When these CDP emissions were compared against the Best Data, all but one company met the minimum “reasonable” disclosure amount. Only one of the companies appeared to have underreported their scope 1 emissions by 28%. Results from the paired t-test are $t=2.11$, $n=18$, $p>0.05$, indicating that the two datasets are not significantly different. A regression analysis was also run and the resulting $r^2=0.99$. The two companies that had significantly higher emissions disclosed in their CSR reported significantly lower emissions in the CDP questionnaire.

Specific Aim #4 - Scope 2 T&D Losses

For specific aim #4, testing was done to determine the company’s transmission & distribution losses (T&D) from purchased electricity. There are 29 utility parent companies included in the study, but only 26 of the companies filed FERC Form 1 reports. For these 26 companies, there were roughly 100 subsidiaries that needed to have their electricity purchases separated into affiliated and nonaffiliated purchases. All 26 companies had nonaffiliated electricity purchases for the year. As a result, all of these utilities should have disclosed scope 2 emissions from T&D losses as a result of the purchased electricity.

The decision to purchase electricity from the grid isn't always the company's choice. There are a couple of scenarios for why the utility would have to purchase electricity from the grid. In a deregulated market environment, the ISO in the area will determine based on lowest price, which power companies are generating power to meet the demand for the day. The utility company may be forced to buy electricity off the grid if they aren't producing enough power for themselves. Companies in regulated markets are usually vertically integrated and are in more control on their power production. They can choose when they want to buy power off the grid.

Of the 26 companies that purchased electricity, 19 (73%) did not report T&D losses for scope 2. Sixteen companies did report scope 2 emissions in their CDP questionnaire, but only six companies specifically noted these emissions as T&D losses. A seventh company disclosed the T&D losses in their CSR report. Only 3 out of 26 companies (12%) disclosed above minimum amount of T&D losses for scope 2 when compared to the "reasonable" estimate for scope 2 emissions. The underreporting of scope 2 emissions was much greater than that for scope 1. All the underreporting for scope 2 was a least 20% below the "reasonable estimate". Two companies underreported their emissions by 20-32%, and the remaining two companies underreported their scope 2 emissions by 78 and 88%. The "reasonable" estimate for scope 2 emissions used T&D loss factors that were specific to each company. In most cases, these loss factors were less than the eGRID2012 grid loss factors. Using the smaller loss factors also resulted in a more conservative estimate of "reasonable" scope 2 T&D losses.

A number of statistical tests were run, including the paired-sample t-test, for the seven companies that had T&D emissions. Based on the results, $t=2.45$, $n=7$ $p>0.05$, indicates that there is no significant difference between the two datasets. The t-test

suggests there is no difference in the means of the disclosed scope 2 T&D losses emissions and the predicted “reasonable” minimum scope 2 T&D losses. A linear regression was run and the resulting $r^2=0.78$, showing more variability in the data than scope 1 (Specific aims 1-3).

Specific Aim #5 - Scope 3 Emissions from Purchased Electricity

For specific aim #5, nonaffiliated purchases of electricity were used to calculate the minimum amount of scope 3 emissions that should be disclosed to account for the purchased electricity. The numbers of companies that are underreporting scope 3 emissions were similar to the scope 2 underreporting. Nineteen out of twenty-six companies (73%) did not disclose scope 3 emissions for purchased electricity. Scope 3 emissions were only disclosed by those companies filing CDP reports. Of the 18 companies that filed CDP questionnaire, only seven companies reported scope 3 emissions for their purchased electricity and only two of these met the projected “reasonable” minimum for their company based on the amount of electricity purchased. Two other companies were fairly close to the “reasonable” minimum projected scope 3 emissions, underreporting within 1.3% and 8.9% of the projected amounts for their companies. The remaining three utilities underreported their emissions by 45%, 46% and 66% below the “reasonable” projected scope 3 amounts. Based on these results, 22 out of 26 (85%) underreported their scope 3 emissions.

A paired-sample t-test was run on the seven companies that had scope 3 emissions from purchased electricity. The results, $t=2.45$, $n=7$, $p>0.05$, indicates that there is no significant difference in the mean of the CDP disclosed data and the projected scope 3 emissions for the companies. A linear regression was run and the $r^2=0.20$ indicating that

the model explains some of the variability. One possible reason for the high variability is that the “reasonable” projection is a very conservative estimate and some of the companies have disclosed much more than the minimum amount. One company disclosed 57 million more MT CO₂e than the projected minimum. On the other end of the spectrum, one company underreported by 12 million MT CO₂e and another company underreported by 5.4 million MT CO₂e.

Inconsistent Reporting by Utilities

The results of this research indicate that electric utilities are doing a decent job disclosing their scope 1 emissions from stationary combustion. One possible explanation is that roughly 80% of the data used to calculate the emissions comes from CEMS data (EPA, 2013). Many of the companies violated the GHG accounting and reporting principle of completeness, since they did not report all of the different types of scope 1 emissions. Three of the companies included in this study, did an excellent job disclosing their scope 1, 2 and 3 emissions and were named to CDP’s Climate Disclosure Leaders Index for 2014. One of these companies was also named to the Climate Performance Leadership Index for 2014.

The rest of the companies in the study did less than a stellar job disclosing their scope 2 and 3 emissions. Seventy-three percent of the companies did not disclose the emission associated with purchasing electricity off the grid, once again violating the GHG accounting and reporting principle of completeness. Only seven companies disclosed their scope 2 T&D losses and scope 3 emissions associated with this purchased electricity. Some of these disclosures were considerably lower than the “reasonable”

minimum estimates developed for each company. The GHG accounting and reporting principle of accuracy may not have been followed by these companies.

The CDP questionnaire contains a tremendous amount of information about the 18 companies that did file their responses for 2014. Much of this information helps explain the variability in the responses and why some companies do not disclose scope 2 or scope 3 emissions. In this small sample of companies, the results confirm what the investors are complaining about. There are inconsistencies throughout the data, making company comparisons difficult. We can see from the CDP data that the companies are not consistent in the boundary chosen, with ten companies using the equity approach, six using the operational control method, two using the financial control method, one using some other type of organization boundary method, and one company used both operational and financial control for their boundary. As a result of these various boundary methods chosen, many of the organization boundaries used do not match those used in their financial statements. This is a problem for the investor.

Calculations of the emissions themselves are done inconsistently. The companies are using different emission factors in their calculations. In the 18 companies that completed a CDP questionnaire, three didn't even mention what emission factors they were using. Of the remaining 15 companies, they were using six different sources for their emission factors. Granted some of these may be the same emission factors, but the companies are getting them from six different sources. The GWPs being used are inconsistent as well. For example the GWP for CH₄ varied among the companies, seven were using SAR, six companies were using AR4, four companies were using other and one company did not disclose which source of GWP they were using for CH₄. The GWP

for methane under SAR is 310, and is 298 under AR4 (GHG Protocol, 2007). This variation in GWP will affect the emissions calculated.

Several different standards were used to calculate emissions and some of these standards have different focuses. Six companies used the EPA's Mandatory GHGRP, one used the EPA's Acid Rain program, ten companies used more than one standard including the GHG Reporting Protocol and one company used other. 2014 CDP questionnaire listed 58 different standards/protocols and the default "Other" because CDP "makes no judgments on standards or methodologies applied by companies to produce their inventories" (CDP, 2014a).

Add on top of all of this, is the issue of these emissions being self-disclosed and self-calculated. These calculations can be difficult and making sure they are done correctly is something that is assessed when a verification is done. Sixty-seven percent of the scope 1 and 2 emissions are not assured, while only 29% of the scope 3 emissions were not assured. This lack of assurance by many companies may also explain why the GHG accounting and reporting principles of completeness, consistency and accuracy appear not followed. Transparency was spotty by many of the companies.

The results of this research coincide with Sullivan's & Gouldson's findings concerning the difficulties seen in comparing climate change performance data between companies, even within the same sector (Sullivan & Gouldson, 2012). My study concluded that the direct emissions (scope 1) disclosed by the companies in this study matched "reasonably" well the stationary combustion emissions reported to the regulatory programs, but there were inconsistencies in the methods arrived at these emissions and the boundaries did not match the financial statement boundaries. With different companies picking and choosing which emissions they were disclosing made

real comparisons of the climate friendliness of companies difficult. The nuances of the electric generation sector also hinder the comparison process. My research also supported Sullivan's & Gouldson's conclusions that it is virtually impossible to make decisions from the company's supply chain or value chain (scope 3) information (Sullivan & Gouldson, 2012). There were inconsistencies in the supply and/or value chain emissions disclosed by the companies in this study, illustrating that it is difficult to make financial decisions based on this data.

My research also agrees with KPMG's findings of "fragmented, inconsistent approaches and patchy transparency" observed in their study (KPMG, 2015). As mentioned earlier, the results of my study show that the electric utilities did a "reasonably" good job disclosing scope 1 stationary combustion emissions, but 73% did not disclose scope 2 and 3 emissions associated with purchased electricity. The lack of consistency in calculating and reporting carbon emissions was seen in data collected from the CDP questionnaire. It showed that companies were using different boundaries, protocols/standards, emission factors and GWPs, resulting in inconsistent emission results being disclosed. Transparency was also lacking in most companies, except for a handful of companies that are considered leaders in the CDP climate change program. All three of these issues make it difficult to compare emissions between companies. My study also highlights the issues found in following the GHG accounting and reporting principles of completeness, consistency, transparency and accuracy.

Possible Reasons for Inconsistent Reporting

So the question begs to be asked; why are these electric utilities underreporting or non-reporting their emissions? There are several possible answers to this question including:

- Do not have credible data to calculate other scopes and types of emissions.
- They do not know how to calculate the other scopes and types of emissions.
- They are using so many different standards and protocols to calculate their emissions and not all programs stipulate that scope 2 and 3 emissions should be calculated (CDP has 58 different calculation methodologies listed). Ten of the utilities in this study used more than one standard for calculations.
- This is a voluntary program and the companies aren't required to disclose all their emissions.
- They thought they were doing a decent job but aren't required to have their emissions assured to check.
- Or some other motivating factor to make their emissions look lower than their peers that are Climate Disclosure and Climate Performance leaders?

Many of these same possible reasons listed above are why the investors have found that the company metrics having to do with GHG emissions are not readily comparable and are inconsistent. Imagine if you were trying to make a decision to invest in a company and you only had a partial listing of their liabilities. Or you only knew a portion of their assets that they own. The investor would be torn whether to make the investment or not based on the data provided. Fortunately there are Securities laws that protect the investor from these types of situations. Presently there aren't these strong

laws that protect investors in the area of non-financial ESG data. If the investors and general public are going to use these self-reported non-financial ESG data such as GHG emissions in a financial manner, it is time to have standards in this area. It is also time that assurance is required for these emission disclosures as well, similar to that required for financial statements. Or a centralized verification system needs to be developed similar the EPA's GHGRP system that will evaluate the quality of the data reported.

On March 29, 2016 Eric Schneiderman, New York's Attorney General announced that he and 15 states Attorney Generals, as well as the District of Columbia and the Virgin Islands will form a coalition to battle climate (New York AG's Office, 2016). Former Vice President Gore was on hand as the coalition announced their support for the EPA's Clean Power Plan and mentioned their plans to investigate Exxon Mobile to see if the company deceived the public and investors about climate change (New York AG's Office, 2016). Last year, New York State reach a settlement with the world's largest publically traded coal company, Peabody Energy on the grounds that they misled the public and investors in their financial statements and disclosures on climate change (New York AG's Office, 2016).

Are some of the underreporting and non-disclosing electric utilities trying to mislead investors that their company is more "climate friendly" than their peers? Hopefully not! Hopefully disclosures will improve in the future. More concrete standards and assurance, similar to that required for financial statement data, will go a long way in helping to disclose the true "climate friendliness" of each electric generating utility.

Appendix 1

Standard Conversion Factors

Table 17. Standard conversion factors.

Mass			
1 pound (lb) =	453.6 grams (g)	0.4536 kilograms (kg)	0.0004536 metric tons (tonnes)
1 kilogram (kg) =	1,000 grams (g)	2.2046 pounds (lb)	0.001 metric tons (tonnes)
1 short ton (ton) =	2,000 pounds (lb)	907.18 kilograms (kg)	0.9072 metric tons (tonnes)
1 metric ton (tonne) =	2,204.62 pounds (lb)	1,000 kilograms (kg)	1.1023 short tons (tons)
Volume			
1 cubic foot (ft ³) =	7.4805 U.S. gallons (gal)	0.1781 barrels (bbl)	
1 cubic foot (ft ³) =	28.32 liters (L)	0.02832 cubic meters (m ³)	
1 U.S. gallon (gal) =	0.0238 barrels (bbl)	3.785 liters (L)	0.003785 cubic meters (m ³)
1 barrel (bbl) =	42 U.S. gallons (gal)	158.99 liters (L)	0.1589 cubic meters (m ³)
1 liter (L) =	0.001 cubic meters (m ³)	0.2642 U.S. gallons (gal)	0.0063 barrels (bbl)
1 cubic meter (m ³) =	6.2897 barrels (bbl)	264.17 U.S. gallons (gal)	1,000 liters (L)
Energy			
1 kilowatt hour (kWh) =	3,412 Btu (Btu)	3,600 kilojoules (KJ)	
1 megajoule (MJ) =	0.001 gigajoules (GJ)		
1 gigajoule (GJ) =	0.9478 million Btu (MMBtu)	277.8 kilowatt hours (kWh)	
1 British thermal unit (Btu) =	1,055 joules (J)	1.055 kilojoules (KJ)	
1 million Btu (MMBtu) =	1.055 gigajoules (GJ)	293 kilowatt hours (kWh)	
1 therm =	100,000 Btu	0.1055 gigajoules (GJ)	29.3 kilowatt hours (kWh)
Other			
kilo =	1,000		
mega =	1,000,000		
giga =	1,000,000,000		
tera =	1,000,000,000,000		
peta =	1,000,000,000,000,000		
1 mile =	1.609 kilometers		
1 metric ton carbon (C) =	⁴⁴ / ₁₂ metric tons CO ₂		

Example Calculation		Convert 1,000 lb C/kWh into metric tons CO ₂ /GJ		
1,000 x	277.8 x	0.0004536 x	44/12	= 462.04 metric tons CO ₂ /GJ
(lb C/kWh)	(kWh/GJ)	(metric tons/lb)	(CO ₂ /C)	

Source: The Climate Registry's General Reporting Protocol version 2.0, p.181

Appendix 2

Regulations that Affect the Electric Utility Sector

Table 18. Regulations that affect the electric utility sector.

Regulatory Driver	Summary Requirements	Regulation Status
Clean Air Act Regulation of Greenhouse Gases (GHG)	<p>Inclusion of GHG in permitting; Projects can trigger BACT for GHG</p> <p>Output-based emission limit for new, modified, reconstructed units</p> <p>State emission limits for existing sources</p>	<p>Supreme Court ruling in June 2014 limits how "Tailoring Rule" applies.</p> <p>-----</p> <p>New unit NSPS re-proposed Jan 2014; final rule Jan 2015</p> <p>-----</p> <p>Proposed rule for modified/reconstructed NSPS June 2014; final 2015</p> <p>-----</p> <p>Proposed NSPS for existing units June 2014; final 2015; state rules 2016 - 2018</p>
Cross-State Air Pollution Rule (CSAPR)	Reduction in NOx and SO2 allowances vs. CAIR; New allowances for trading program (state level caps)	In April 2014, Supreme Court reversed District Court Decision made in Aug 2012 to vacate rule; the District Court will make a decision on how and when to proceed; CAIR remains in place until CSAPR resolved
Revisions to National Ambient Air Quality Standards (NAAQS)	Lower PM, NOx and SO2 limits; Expansion of non-attainment areas	<p>SO2 final rule June, 2010; Initial attainment designations final Oct 2013; Nonattainment plans due April 2015; final rule for other areas 2015.</p> <p>-----</p> <p>Fine particulate (PM2.5) lowered 1/15/2013; Attainment designations 03/2015; Nonattainment plans 2018.</p> <p>-----</p> <p>Ozone proposal to lower 12/2014; Final 12/2015; Attainment designations 2017; Nonattainment plans 2020+</p>
Clean Air Visibility Rule (CAVR)	Application of Best Available Retrofit Technology (BART); Targets reduction in transported SO2 and NOx; Satisfied by CAIR in Missouri; status of CSAPR may require state to change approach.	Final rule issued by EPA in 1999; States submit progress reports in 2013 CSAPR resolution may require changes to state rule.
Mercury and Air Toxics Standards (MATS)	Reduction in emissions of Mercury, HCl (proxy for acid gases) and particulate emissions (proxy for non-mercury metals)	Final rule released by EPA December 21, 2011; published in Federal Register February 16, 2012; effective April 16, 2012.
Clean Water Act Section 316(a) - Thermal Standards	Potential revisions to existing thermal limitations on once-through cooling systems; Implementation through NPDES permit conditions	Evaluation triggered by NPDES permit renewals
Clean Water Act Section 316(b) - Protection of Aquatic Life	Case-by-case determination of controls required to meet entrainment standards; national standard for impingement	Final rule from EPA effective October 2014
Coal Combustion Residuals (CCR)	Conversion to dry bottom ash and fly ash; Closure of existing ash ponds; Dry disposal in landfill	Final determination from EPA on haz/non-haz Dec 2014; final rule late 2014/early 2015
Revisions to Steam Electric Effluent Guideline Limitations (EGL)	Lower effluent emissions for existing parameters; Installation of wastewater treatment facilities; Implemented through NPDES permit conditions	EPA proposal April 19, 2013; final rule Sept 30, 2015; linked to CCR rule

Source: Ameren Energy – 2014 Integrated Resource Plan, Chapter 5 – Appendix A

Appendix 3

CDP Questionnaire for GHG Emissions Accounting

Table 19. CDP 2014 questionnaire for GHG emissions accounting.

Module: GHG Emissions Accounting, Energy and Fuel Use, and Trading	
Question #	Question from Questionnaire
CC7.1	Please provide your base year and base year emissions (Scopes 1 and 2)
CC7.2	Please give the name of the standard, protocol or methodology you have used to collect activity data and calculate Scope 1 and Scope 2 emissions
CC7.2a	If you have selected "Other" in CC7.2 please provide details of the standard, protocol or methodology you have used to collect activity data and calculate Scope 1 and Scope 2 emissions
CC7.3	Please give the source for the global warming potentials you have used
CC7.4	Please give the emissions factors you have applied and their origin; alternatively, please attach an Excel spreadsheet with this data at the bottom of this page
CC8.1	Please select the boundary you are using for your Scope 1 and 2 greenhouse gas inventory
CC8.2	Please provide your gross global Scope 1 emissions figures in metric tonnes CO ₂ e
CC8.3	Please provide your gross global Scope 2 emissions figures in metric tonnes CO ₂ e
CC8.4	Are there any sources (e.g. facilities, specific GHGs, activities, geographies, etc.) of Scope 1 and Scope 2 emissions that are within your selected reporting boundary which are not included in your disclosure?
CC8.4a	Please provide details of the sources of Scope 1 and Scope 2 emissions that are within your selected reporting boundary which are not included in your disclosure
CC8.6	Please indicate the verification/assurance status that applies to your reported Scope 1 emissions
CC8.6a	Please provide further details of the verification/assurance undertaken for your Scope 1 emissions, and attach the relevant statements
CC8.7	Please indicate the verification/assurance status that applies to your reported Scope 2 emissions
CC8.7a	Please provide further details of the verification/assurance undertaken for your Scope 2 emissions, and attach the relevant statements
CC9.1	Do you have Scope 1 emissions sources in more than one country?
CC9.1a	Please break down your total gross global Scope 1 emissions by country/region
CC9.2d	Please break down your total gross global Scope 1 emissions by activity
CC10.1	Do you have Scope 2 emissions sources in more than one country?
CC10.1a	Please break down your total gross global Scope 2 emissions and energy consumption by country/region
CC10.2c	Please break down your total gross global Scope 2 emissions by activity
CC12.2	Please describe your gross global combined Scope 1 and 2 emissions for the reporting year in metric tonnes CO ₂ e per unit currency total revenue
CC12.3	Please describe your gross global combined Scope 1 and 2 emissions for the reporting year in metric tonnes CO ₂ e per full time equivalent (FTE) employee
CC12.4	Please provide an additional intensity (normalized) metric that is appropriate to your business operations
CC14.1	Please account for your organization's Scope 3 emissions, disclosing and explaining any exclusions
	Fuel-and energy-related activities (not included in Scope 1 or 2)

Appendix 4

Calculating Emissions

The most widely accepted methodologies for developing a carbon inventory are found in the *GHG Protocol Corporate Standard* and *ISO 16064-1*. To develop an accurate inventory based on the *GHG Protocol Corporate Standard*, the reporter would need to determine the boundaries of reporting as stated in the standard. GHG accounting and reporting boundaries have several dimensions, such as organizational, operational, geographic, business unit and target boundaries. The inventory boundary determines which emissions are accounted and reported by the company (TCR, 2013). The reporter would then need to identify the appropriate emission sources, select the appropriate calculation approach, collect the data, choose the correct emission factors, apply the calculations tools and roll-up the data to the corporate level (TCR, 2013).

The Climate Registry (TCR) has standards and sector specific protocols for the various organizations that are voluntarily reporting their emissions. Members can put their energy consumption information into TCR's Climate Registry Information System (CRIS) and it will calculate their emissions.

The mechanism for calculating direct emissions is essentially the same for all the protocols. For example, to calculate USPS' CO₂ mobile emissions for the State of Delaware, the reporter would need to first determine the annual fuel consumption then select the appropriate emission factors for CO₂, to determine the total CO₂ emissions.

Per The Climate Registry, an emission factor is a unique value for determining an amount of a greenhouse gas emitted on a per unit activity basis (for example, metric

tonnes of CO₂ emitted per million BTUs of coal combusted, or metric tonnes of CO₂ emitted per kWh).

To simplify the mobile emissions calculation of CO₂, it is assumed that all USPS vehicles in Delaware run on gasoline.

Table 20. Mobile emission calculations of CO₂.

CO ₂ Emissions (metric tonnes)	=	Fuel Consumed (gallons)	x	Emission Factor (kg CO ₂ /gallon)	÷	1000 (kg/metric tonne)
Gasoline CO ₂ Emissions	=	509,112	x	8.78	÷	1000
	=	4,470 metric tonnes CO ₂				

Source: How Big is Your Footprint (McIntosh, 2012).

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